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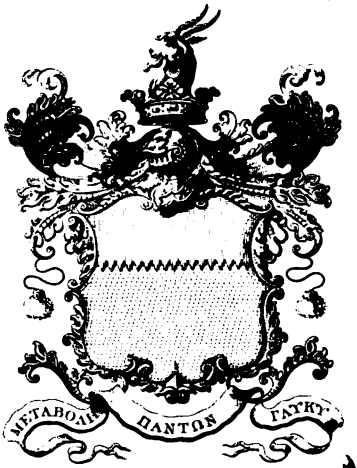

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PUBLISHED BY THE

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SECOND SERIES.

VOLUME THE FIFTH.

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PRINTED FOR LONGMAN, ORME, BROWN, GREEN, AND LONGMANS, PATERNOSTER ROW.

1840.

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Friederich Tiedemann, M.D., *Professor of Anatomy and Physiology, Heidelberg.*

Giacomo Tommasini, *late Professor of Clinical Medicine in the University of Bologna, and Member of the Societa Italiana; Parma.*

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A CASE

OF

STRANGULATED HERNIA,

IN WHICH THE BOWEL WAS RUPTURED BY THE PATIENT IN HIS EFFORTS TO REDUCE IT.

By BENJAMIN TRAVERS, Esq., F.R.S.,

SURGEON EXTRAORDINARY TO THE QUEEN,
SURGEON IN ORDINARY TO HIS ROYAL HIGHNESS THE PRINCE ALBERT,
AND SENIOR SURGEON TO ST. THOMAS'S HOSPITAL.

READ NOVEMBER 12TH, 1839.

At 3 o'clock A. M., on the 29th October 1839, I was summoned three miles from town, to visit a young gentleman, supposed to be the subject of strangulated hernia. The patient, aged twenty, of muscular frame, I found lying upon his back, with a countenance expressive of great suffering and anxiety, his surface pale and chilled, eyes and lips livid, legs drawn upwards, pulse at the wrist imperceptible, and the heart's action rapid and indistinct. He had vomited several times, but had passed a motion at four in the afternoon of the preceding day. The scrotum was enlarged to the size of a young child's head, and discoloured of a gangrenous hue; the skin distended as if about to burst. The hypogastrium was swollen and tense, the pain acute, diffused and much increased on pressure. I was informed that he had recently laboured under go-

norrhœal inflammation, and swelled testis on the right side, and had been the subject of hernia on the same side, from his birth; that he had not worn a truss since his childhood, but was in the habit of lying down, and replacing the protruded bowel with his hands, when inconveniently distended in the sac; always maintaining a strict reserve on the subject of this malady.

Upon further inquiry, I learned that at six o'clock of the preceding evening, the volume of the tumour became so increased, as to oppose a resistance to its return, which the young man could not overcome. In addition to continued violent manipulation, he compressed it forcibly between his hands and thighs, and as if reckless from ill success, actually made a section of the integument with a razor, transverse to the chord. At midnight, he sent for his father, and told him he had burst his testicle, or that something had given way, and if unassisted, he must die. The bulk of the swelling had gone on increasing, from this time, to the period at which I visited him.

Having explained the alarming nature of his symptoms to his father, I gave him some warm brandy and water to drink, which restored a very slender pulse, and then made an incision in the tract of the spermatic chord, towards the fundus of the tumour. The subcutaneous cellular membrane was throughout infiltrated with a dark-coloured fluid, emitting a feculent odour, and freely oozing from the section. The subjacent cremaster tunic was

then divided, and the collapsed sac, forming an enormous pouch, divided, and incised on a director: the testis lay exposed and somewhat swollen in its lower part, and a flaccid fold of bowel occupied the mouth of the sac, which on handling the parts, slipped into the belly. The finger passed freely through the dilated canal and upper orifice, round the epigastric vessels, into the abdominal cavity. There was nothing like stricture to be perceived at any part. A single stitch was placed in the edges of the sac, which was condensed on the posterior part, and of a loose cellular texture on the anterior and lateral parts. The divided integuments were also connected by a central stitch, over a dossil of lint; a free incision carried through the raphé scroti posteriorly, exhibited a similar loaded state of the cellular membrane behind, as in front, and extending far beyond the mesial line.

This completed the operation: the fluid which had escaped in such quantity as to form a pool in the bed, had so much the appearance of effused and putrid blood, as to be at first mistaken for it; no blood was lost during the operation, which was followed by some temporary relief and recovery of the circulation. While it was proceeding, the patient threw up some frothy bilious fluid, and very soon afterwards had two pretty copious stools of semi-fluid consistence, and precisely of the same colour as the effused intestinal fluid.

Restlessness however soon returned, and at 7

o'clock, three hours from the completion of the operation, he died.

Inspection ten hours after death.—The abdominal muscles were rigid, and a vast quantity of offensive flatus escaped on making the ordinary section, and through the scrotal wound. On tracing the small gut, a portion of the lower third of the ileum, equal to a hand's breadth in extent, presented the appearances of recent strangulation, accompanied with laceration, and extravasation of blood between the peritoneal and muscular coats. The fold was collapsed, of a claret colour, bounded by a faint ash-coloured streak at either end, and presenting three or four insulated grey spots of incipient gangrene. An irregular aperture, three-fourths of an inch in length, was found adjacent to the mesenteric attachment, and parallel to the axis of the bowel; and immediately contiguous to this wound, the serous membrane was detached from that beneath it to the extent of an inch, so as to exhibit the circular fibres of the muscular coat, as if dissected. Minute clots of blood were lying in this space, and some extravasation had taken place between the layers of the corresponding mesentery. The neighbouring small intestine was at several points inflamed, and congested even to extravasation beneath the peritoneal investment; liver reduced as if shrunk in bulk; its surface of a dark green hue, and slightly roughened. On section, it was tougher and paler than this tissue ordinarily is in youth and health.

OBSERVATIONS.

The rupture of an intestine by efforts made for its reduction by the surgeon or the patient is happily of rare occurrence; and never I believe occurs, the bowel being in a sound state. In the case now related, the rupture, accompanied by extraordinary dilaceration of the coats of the bowel, was occasioned by the violence of the patient, encouraged by the uniform success of his former efforts, and alarmed perhaps by contemplating the consequences of failure.

At Brighton, some weeks previous to his death, he had experienced difficulty in returning the bowel, and had recourse to a warm bath. He was at that time labouring under the swelled testicle.

The razor cut, in the groin, evinced a state of desperation bordering on insanity. The patulous orifices of the inguinal canal, both external and internal, the perfect freedom from stricture of the tunica vaginalis, forming the sac, and the absence of all adhesions, suggest an inquiry into the cause of an incarceration, presenting so obstinate an impediment to replacement; and the amount of injury so inflicted further suggests the question, whether the bowel was previously altogether free from diseased change.

The portion of small bowel which had been confined in the sac, and subjected to fatal pressure, was sufficiently defined by colour, and incipient gan-

grenous spots, as well as the two faint striæ, of an ashy hue, indicating the line of stricture; the distension of its cylinder by feculent fluid, *gradually* accumulated, could alone have operated to produce a state of strangulation by patulous apertures, considerably approximated. The swollen state of the spermatic chord, corresponding to the swelled testis, may have diminished somewhat the area of the canal.

This case therefore was, what the French writers call "hernie par engouëment," and is that species of stricture to which persons having an irreducible hernia are most exposed, but to which they also are liable who, wearing no truss, rely upon their own vigilance and their own exertions to anticipate or relieve strangulation; for in cases where the hernia is of long standing and the ring is large, a portion of gut must be generally lying in the sac during the erect position of the body, and subject to become loaded, especially in morbidly increased hepatic or intestinal secretions. A bowel so situated would be liable to gradual filling, and the production of passive stricture, *i. e.* of stricture determined, not by the narrowness or the contractility of the orifice, but by the choked state of the bowel. To a certain extent this principle of reaction operates in all cases by the evolution of gas within the displaced bowel; but in that species of hernia to which I refer it *produces*, whereas in others it only *augments*, the resistance. In the present case the combined power of the tricipites femoris muscles to compress the swelling, and

manipulation unskilfully applied, had ruptured both sac and bowel, and collapse of the gut soon followed the free issue of its contents into the cellular membrane of the scrotum. A state of vascular congestion we must presume had pre-existed as in all cases of strangulation, but there was no evidence of previous disease, nor any appearances for which recent violence might not account; and the effusion of adhesive matter, rapid as that process is upon serous membrane, had not taken place.

The state of the liver was unhealthy, and the profuse and vitiated discharge from the intestine renders it probable that the patient's habits were intemperate; an opinion which the presence of a crop of warts bathed in gonorrhœal matter served to confirm. I regret much that the mucous membrane of the stomach and bowels was not examined.

Had the surgeon's aid been called in upon the young man's discovery of his inability to replace the bowel, there is no reason to doubt that it would have yielded to the temperate application of the taxis.

I have known the intestine ruptured in the taxis, but it was ascertained that the stricture included two thirds only of the cylinder, which was sloughy and separating by ulceration.

A man received a violent blow from a hammer on the pad of his truss, while stooping, by which the bowel was ruptured. This event was favoured by

position, but could not have happened had the truss been efficient.

From compression, as by a wheel passing over the body, or pinning it against a wall, from the kick of a horse, from a fall across a beam, from running violently against a post in the dark, and similar causes, I have known the bowel ruptured; sometimes in more places than one, and sometimes complicated with lesion of the liver, spleen, or kidney, without breach of the walls of the abdomen. Distorted muscular action is sufficient to produce rupture of the stomach in a loaded state, as I witnessed many years ago in the case of a tumbling boy, who a few minutes before had been partaking freely of apples and gin, which were effused.

I never knew a case of ruptured intestine from vomiting or muscular action, unless ulcer had previously existed, by which the internal tunics were destroyed; in this case the peritoneum covering the aperture is probably burst, for the symptoms of effusion commence almost simultaneously with the act of vomiting. This act, I may observe, is abridged and impeded after rupture of the canal at any part; it is half vomiting and half expectoration, as if the muscles had lost their fulcrum, which is in fact the case; the fluid rises into the fauces, and is with a convulsive effort spit out of the mouth.

The symptoms following ruptured bowel are death-like from the moment of the injury. They are quite unlike those of inflammation and of gangrene, and are indeed 'sui generis.' The mind is

clear but depressed, as if overwhelmed by the irreparable nature of the injury. The countenance is pale and the features liny and drawn. The pulse is not immediately affected, but soon becomes quick, feeble, and irregular in its measure, intermitting, thready, and then no longer to be felt. The surface chills, but remains dry; there is a painful sense of dryness of the mouth and fauces, and frequent efforts to vomit in the way before described. Pain, which commences at variable periods, but is never long delayed, is acute, unremitting, extending over the whole abdominal region, which becomes tense and will not bear the slightest pressure. This produces great anxiety and restlessness, and frequent appeals for relief, and next for death. The peritoneal surface is reddened, but there is seldom any effusion of membranous or massive lymph agglutinating parts; only small deposits in tags and shreds roughening the surface, although the period of survival varies from twelve to six-and-thirty hours: the state of the canal perhaps determines this variation.

Granting the irreparable nature of this injury, it is worth while to inquire whence the mortal stamp of the symptoms is derived at the moment of its infliction. The amount of change by inflammation falls short of what is observed in most cases of peritonitis and of hernia. The symptoms of prostration are so immediate as to put aside all idea of blood-letting: opiate suppositories have not the smallest influence; the pain is not only intolerable, but is unremitting and insusceptible of relief, which

is not often the case in inflammations otherwise induced.

The nervous shock must be as great, we should suppose, in the unhappily common accident of broken dorsal spine, in which the patient is instantaneously deprived of the real sense of existence in the lower half of the body, or half devitalized, as if he were cut in two: here there is no direct or diffused inflammation, no pain, nor are the symptoms of dissolution apparent for days or even weeks. The effusion of *blood* is innoxious to the peritoneal surface. The air which escapes from the canal, immediately upon the lesion, probably acts as a poison upon the nervous and absorbent tissue of the surface exposed to it, and its deadly influence increasing with the time may perhaps explain the peculiarity and rapid progress of the symptoms. I may mention that I have known cases in which the symptom of *pain* was so much less marked than usual, as to lead some to doubt the nature of the injury.

The solitary indication which these most distressing cases afford is unhappily contravened by the first impulse of the attendants to administer a cordial, as spirits and water, for example; and of the doctor, who thinks only of inflammation, or of opening the bowels by a purging draught, preparatory to other measures. I believe that little, if any, of the fluids swallowed, pass beyond the stomach, or remain there, unless in the very commencement of the case. An absolute negation of sustenance or

diluent of any kind, except to rinse the mouth, would however be the most rational plan of treatment to follow.

With the permission of the Society, I shall take the present opportunity of briefly recounting the particulars of two cases of strangulated hernia, which occurred to me in the year after my election to St. Thomas's Hospital, by which the practical question of returning the hernia into the abdomen, *without opening the sac*, was raised, and finally negatived in my mind.

John Kelf, aged twenty-one, had a congenital hernia of the left side, for which he had generally worn a truss, but having broken his truss, had neglected to procure another. The hernia was largely protruded after a fall on the evening of the 20th of January 1816; he was unable to return it as usual, and he was admitted next day into St. Thomas's Hospital, with frequent vomitings, and other symptoms of acute strangulation. The tumour, which appeared to consist of both gut and omentum, was large, tense, coloured, and very painful to the touch. The warm bath, a full bleeding, cold applied to the scrotum, and the tobacco enema, in addition to two or three prolonged trials of the taxis, being found ineffectual, the operation was performed at one o'clock on the 21st January.

There was found to be a double stricture; the first formed by that portion of the intercolumnar fibres

which complete the upper margin of the external ring. These, which formed a tense crescentic band at the neck of the sac, and were strongly marked externally, being divided, the hernia was partially liberated. After a further division of the superior pillar of the ring, upon a director, the contents of the sac rapidly and completely ascended into the abdomen, on applying gentle pressure to its sides. The relief of the patient was instantaneous, and the wound healed quickly; so that he left the hospital with a proper truss, on the eighth day of the following month.

In this very encouraging case, the strangulation, though the symptoms were urgent, had not existed more than eighteen hours.

On the 22nd of October of the same year, was admitted John Bishop, aged fifty-five, with a femoral hernia of the right side, and the symptoms of strangulation, which had existed for three days. The usual means of relief having failed, the operation was done without delay. There was found, beneath a suppurating lymphatic gland, a small and very tense sac. The fibres of the crural arch were divided upon the point of the finger; but it was found necessary to carry the probe-pointed bistoury under the arched fibres of the fascia transversalis, in order to liberate the contents of the sac, which returned with a gurgling noise into the belly. The return of the gut, and collapse of the sac, were perfect and satisfactory; the latter was in consequence not opened. The patient was imperfectly

relieved; vomiting continued at intervals throughout the rest of the day and night, although several scanty, dark, and scybalous stools were obtained by injection, and small doses of aperient salts.

The second day he kept gruel on his stomach, and was free from abdominal pain; but the pulse was thready, and he was ordered a small quantity of wine.

The third day he was very restless, but had several copious evacuations and a clean tongue.

The fourth day bilious vomiting recurred; he complained of pain in the wound, spreading over the whole abdomen, and had a fuller pulse (90), and a furred tongue. In the afternoon the pain and pulse increasing, he was bled to ℥xvj, and twenty leeches were applied to the abdomen. In the evening, the pain being unrelieved, he was again bled to ℥viij. The blood was neither cupped nor buffed; pulse 126, and small; breathing laborious; wound open and sloughy.

Fifth day. Had passed a good night, and was free from pain. In the course of the day he vomited frequently, and again complained of pain in the belly. Pulse 106, and feeble; breathing laboured; tongue furred; copious evacuation from the bowels.

Sixth day. Abdomen tense and swollen; no pain on pressure. Towards evening he was slightly delirious, and had cold extremities. I excised the sac close to the crural arch with curved scissors.

Seventh day. Vomiting and tumefaction have

subsided; bowels sufficiently relieved, but the patient is restless and desponding. Blister applied to the abdomen.

Eighth day. A restless night; blister had risen well; patient frequently crying out with pain, which had now become general; was but partially sensible; at 9½ P. M. died.

Examination twelve hours after death.—Stomach distended; small intestines moderately full; peritoneum presented some red specks at the angles of contact of the intestinal folds. A portion of the tube of the ileum was disorganized, being an ash-coloured rag; but an adhesion at the mouth of the sac included this piece, so that it was not seen on opening the abdomen, nor until the adhesion gave way, when a quantity of pultaceous feculent matter passed into the pelvis. Another fold of intestine adhered to the sound side of this, and supported it against the ring. A portion equal to one-third of the canal of the strictured gut was sound, and freely admitted the passage of a bougie, and by this route the feculent matter had passed from the upper to the lower part of the tract. On the mouth of the sac was deposited a lip or elevated border of lymph, corresponding to the line of separation of the slough from the living edge, so that no effusion into the belly could have taken place.

OBSERVATIONS.

Judging from the state of the dead piece, which tore like wetted paper, an artificial anus would have been established in twenty-four hours; indeed a considerable oozing of feculent matter had been observed on the day of the patient's death.

The dead piece of gut had been strangulated, and returned at the time of the operation. It went on to gangrene, lying over against the mouth of the sac. This, and the adjoining fold were so placed, as to dispose to the formation of artificial anus, and had that fortunately been accomplished, the man would in all probability have survived. It cannot be known what the actual state of the gut was, when replaced, as the sac was not opened; but as it was elastic, and no symptoms of gangrene present, we must conclude that its state was one of intense disorganizing inflammation. The vomiting was obviously relieved by the alvine evacuations; but the action of the intestines was imperfect in the dead portion, which occasioned a partial obstruction, and consequent recurrence of the symptoms. If the whole cylinder had been gangrened, the obstruction would have been complete, and instead of living a week, and vomiting at intervals, the vomiting would have been incessant, and death would have taken place in half the time, provided no discharge had been set up at the groin. *This* would probably have saved the man in either case, because it would have tranquillized the stomach. Not only

was no benefit gained, but the separating process was retarded by the integrity of the peritoneal sac. Had this been opened by the ordinary incision at the time of operation, both the sloughing and the adhesive process would have been so much accelerated, as to have established the artificial anus in time for the patient's relief, and ultimately, perhaps, the continuity of the canal.

I believe that the advantage is altogether hypothetical which is supposed to accrue from preserving the sac entire, in cases where the gut is simply paralysed, and unable to resume its function, the ordinary cause of failure of the operation for hernia; and that the practice is decidedly disadvantageous in all cases where inflammation is of such standing as to have endangered the continuity of the canal; for of such cases, doubtful as is the alternative, the only chance of recovery is in the speedy relief of the symptoms by artificial anus. The incision of the sac establishes at once a free fistulous opening into the peritoneal cavity, and identifies it with the external wound, which materially quickens the separating, and strengthens the fastening process; the spoiled bowel being left *in sitû* at the mouth of the sac.

I therefore regard the first of these cases as forming a rare exception to a general rule of practice. The stricture of the external ring being removed, the return of the bowel was almost spontaneous. But not to insist upon the numerous cases in which the seat of stricture or the existence of adhesions does not

permit us to leave the sac entire, the practice is objectionable, on the ground that where the stricture is of such firmness as to require the aid of the knife, we can never know the actual state of the bowel, with which it is the paramount duty of the surgeon to make himself acquainted, that he may regulate his proceedings accordingly.

I have adverted to the paralysed condition of the strangulated bowel, as the ordinary cause of death after the operation for hernia. This opinion, which I published near thirty years ago,* has been fully confirmed by my larger experience; yet it is not, I believe, generally entertained. Death is ascribed to the inflammation of the general cavity, where gangrene of the gut has not supervened upon its replacement: but in how few cases does inflammation prove intractable, when the operation is followed by full evacuations, demonstrating the re-establishment of the canal. I have repeatedly seen patients, after operation, in whom the symptoms of inflammation were feebly, if at all, indicated, and have inspected many 'post mortem,' in whom no agglutination interfering with the function of the bowel had taken place, or other explanation of the continued obstruction showed itself, than the utter atony of the congested bowel, which had been replaced; marked by its precise interposition to the

* An Inquiry into the Process of Nature in repairing Injuries of the Intestines, illustrating the Treatment of Penetrating Wounds and Strangulated Hernia. London, 1812.

flatulent portion of the tube above, and the collapsed piece below.

To combat inflammation, according to modern theories, mercury has been administered in every possible emergency; even in injuries of the head, attended with stupor and convulsion, and after the operations of lithotomy and hernia it has not been withheld, and I can attest its decidedly beneficial effect in some remarkable instances. The employment of mercury in these cases (like the application of leeches and the knife in acute inflammation of external parts) is of modern introduction. Our immediate predecessors would have considered it inadmissible, even as a speculation; but to them its powers were unknown. The overflow of bile upon the stomach is one of the most invariable symptoms of hernial or mechanical obstruction; its diversion downward is the leading indication after the replacement of the bowel. The vomiting which survives the operation is limited, or nearly so, to the return of the fluids given, whether drink or medicine; it is little, if at all, spontaneous. The redundancy of the biliary secretion is checked by the removal of the stricture, and the liver becomes comparatively inactive. I have given calomel, with an addition of opium, at short intervals, with the best effect, and have seen, as I believe, life saved by its administration. The natural stimulus restored to the mucous surface of the bowel, must be, I imagine, the most effectual to procure a return of its natural action. It may and will fail; but if in-

flammation be present, we cannot treat it more effectively than by giving two grains of calomel, with a quarter or half a grain of opium, every hour or every second hour, *pro re nata.* And thus supported on each hypothesis, I venture to recommend it, in the common, but desperate case, in which the gut having been replaced by operation, sound in texture, however congested, and no such constitutional signs of gangrene being present, as thready pulse, cold sweats, and insensibility to pain, the natural relief of the bowels fails or proves insufficient to arrest the symptoms.

OBSERVATIONS

ON THE

BLOOD-CORPUSCLES AND PUS-GLOBULES

IN CERTAIN ANIMALS.

By GEORGE GULLIVER, Esq., F.R.S., F.Z.S.,

ASSISTANT SURGEON TO THE ROYAL REGIMENT OF HORSE GUARDS.

Communicated by JOHN G. PERRY, Esq.

READ NOVEMBER 26TH, 1839.

Since the time of John Hunter, it has been supposed that the globules of pus are merely the red particles of the blood, deprived of their colouring matter, and modified in form and size by the inflammatory process. At an early period of my inquiries I was led to entertain this hypothesis, as I believe had been previously done by the late Dr. Young, Sir Astley Cooper, Mr. Mayo, and Dr. Carswell, as well as many other eminent pathologists. On the continent, indeed, M. Gendrin asserted that he had actually seen, by means of the microscope, the blood-corpuscles transformed into those of pus. But Professor Müller and Dr. Güterbock did not assent to the supposition that the globules of pus were only the red particles of the blood which had undergone

a change; and some observations on the elementary structure of the pus-globule, which I communicated to the society last spring, led me to believe that there was an essential difference between the corpuscles of blood and those of pus, notwithstanding the many remarkable circumstances in favour of the old opinion. The variety, for instance, in the magnitude of the blood corpuscles, is very great, and the disproportion in size and form between them and the globules of pus almost wholly disappears, if the former be subjected, during examination, to the action of certain reagents.

During last year at Windsor, with the assistance of Mr. Siddall, I made a series of experiments on the blood and pus of various animals. But my observations, though very numerous, did not afford such satisfactory results as might have been anticipated; for the size of the globules of pus is so extremely variable, that however small the corpuscles of the blood were in the animal under examination, there would certainly be some globules of pus equally small, while others of greater magnitude might possibly have been formed by the aggregation of the more minute granules. It might be supposed that the average size of the pus globules would be the same in one species, but this did not appear to be the case: thus in the human subject, pus from an abscess in the neck presented globules, of which the most common size was $\frac{1}{2666}$th of an inch; the extreme diameters being $\frac{1}{4000}$th and $\frac{1}{1333}$rd, and numerous molecules were seen from $\frac{1}{12000}$th to

$\frac{1}{8000}$th of an inch in diameter. In a case of gonorrhœa examined at the same time, the common size of the globules, which were remarkably definite and regular, was $\frac{1}{3000}$th of an inch; this was on the fourth day of the disease. The globules examined again, on the ninth day, were most frequently $\frac{1}{2400}$th of an inch in diameter, the extreme sizes being $\frac{1}{3200}$th and $\frac{1}{2000}$th; on the 12th day the average sized globules were again $\frac{1}{8000}$th of an inch. The variation of their magnitude was not less remarkable in many brutes. In the horse, the most frequent size of the globules of some pus from an abscess in the groin was $\frac{1}{3000}$th; from an abscess in the same horse's leg, a few days subsequently, the particles were generally smaller, the most frequent diameter being $\frac{1}{3200}$th, with numerous globules of $\frac{1}{4000}$th and $\frac{1}{8333}$rd of an inch. The corpuscles of the blood in this animal are uniformly smaller than in man, so that a partial view might lead to the conclusion that this experiment was valuable in establishing the relation between the blood corpuscle and that of pus. But it would be tedious to relate how many contradictory results I obtained by reference merely to what appeared to be the average magnitude of particles so variable in this respect as the globules of pus.

Hence it became necessary to extend the inquiry to animals possessing oval blood-corpuscles. As I have related elsewhere, * experiments on reptiles and

* Lond. and Edin. Phil. Mag., Sept. 1838, and Medical Gazette, Nov. 1st, 1839.

birds were unsatisfactory. The recent discovery by M. Mandl, of the elliptical form of the blood disks of the dromedary and paco, led me to examine them in the vicugna and lama, in both of which I observed that the particles of the blood also possessed an extremely well-defined oval figure. The remarkable difference between these and the disks hitherto known in any other mammal, is a very interesting fact in the comparative anatomy of the blood. The following notes of these corpuscles were made at the time of the examination. The measurements are given in fractions of an English inch; the first indicates the small, and the last above the line the large extreme; the intervening numbers were obtained from disks which were present in abundance.

1. Dromedary (Camelus dromedarius).

Long diameter,

1—4266
1—4000
1—3200
1—3000
1—2460

Average . . 1—3254

Short diameter,

1—7110
1—6600
1—6400
1—5333
1—4800

Average . . 1—5921

The disks were very flat in relation to the diameters, the edges being only $\frac{1}{20000}$th to $\frac{1}{15000}$th of an inch thick; their surfaces presented no projection whatever, and no nucleus could be detected in them by the most careful manipulation, with the aid of various reagents.

2. Paco (Auchenia paco). The disks scarcely differed in form and size from those of the dromedary.
3. Guanaco or wild lama (Auchenia glama). The corpuscles also as in the dromedary.
4. Vicugna (Auchenia vicugna). The corpuscles slightly smaller than in the preceding animals.

	Long diameter,
	1—5333
	1—4000
	1—3555
	1—3200
	1—2666
Average . .	1—3555

	Short diameter,
	1—8000
	1—7110
	1—6400
	1—6000
	1—5333
Average . .	1—6444

The shortest corpuscles are often the broadest; these appearing nearly circular, and occasionally perfectly so. It was interesting to observe in the blood of the camelidæ a few of the comparatively large white globules, forming a singular contrast to the minute oval disks. The blood corpuscles of birds, though of the same shape as those we have been describing, are generally about twice the size, and differ also in structure. In the mammal, as has just been remarked, nothing like a central particle could be detected in the blood disk; but in birds, this may easily be demonstrated by various reagents; and it is very remarkable in its figure, being an extremely elongated ellipse. Thus, as is often the case, if the long diameter of the corpuscles of the bird be a little less than twice the short diameter, the nuclei will measure nearly thrice as much in length as in breadth.

From the vicugna and paco, I had an opportunity of obtaining some pus, and of ascertaining that it did not differ materially from that of animals with circular blood-disks. The globules of the pus of the former animal were extremely well defined, spherical, and rather less granular on the surface than common. They readily exhibited their central molecules when subjected to the action of sulphurous or acetic acids; with water the globules became enlarged, as I have often observed in the recent pus-globules of man and other animals. Their size when examined in their own serum, was generally from $\frac{1}{4000}$th to $\frac{1}{3200}$th of an inch; the extreme diameters being $\frac{1}{4800}$th and $\frac{1}{2666}$th. When treated

with water they expanded to upwards of $\frac{1}{2000}$th of an inch.* There were a few irregularly oval particles in the pus; not more so, however, than may sometimes be seen in the pus of the horse or cat.

The pus of the paco had similar characters. The globules were remarkably clear, and presented very well defined outlines; their most frequent diameter was $\frac{1}{3200}$th of an inch, and $\frac{1}{3000}$th was also a common size; many were only $\frac{1}{4570}$th and $\frac{1}{4000}$th, and several were as large as $\frac{1}{2666}$th. There were, besides, some molecules varying from $\frac{1}{10000}$th to $\frac{1}{8000}$th of an inch in diameter. Under the action of acetic acid, the nuclei of the pus-globules, corresponding in size and appearance with the molecules, were immediately visible; and the entire globules were enlarged by the addition of water. Mixed with a little liquid ammonia, the pus became very ropy, and the globules soon disappeared. When some of the blood-corpuscles were seen with the pus-globules, the diameter of most of the latter was evidently greater than that of the former.

It should be observed that suppuration takes place often with difficulty, and generally very sparingly, in the camelidæ, as far as my experience goes. But though the pus is only obtained in small quantities, its characters, as previously described, are very well marked. The purulent matter in a very few days becomes tenacious and viscid, and indeed soon al-

* For some observations on this subject see Medical Gazette, Nov. 1st, 1839.

most ceases to appear, a tough fibrinous mass occupying the wound.

Without asserting the impossibility of a transformation of the blood-disk into the globule of pus, it can hardly be supposed that any such change took place in the experiments recorded in this paper. This question, however, appears to me to be one of more difficult solution by mere microscopic observation than would be supposed by any one who had not specially examined the subject; for the blood-corpuscles are so singularly susceptible of modifications in form, size and general characters from very slight agency, that examples might readily be shown of their approximation in appearance to the globules of pus. The action of water on the blood-disks of the mammalia, as well as of the lower vertebrate animals, has been well known since the time of Hewson.

Now, however, that so much attention is devoted to the constitution of the healthy as well as morbid animal fluids, the relation, if any, between the blood corpuscles and the particles of the secretions will probably be soon finally determined. From my observations it appears that the blood-disks of the goat are by no means the smallest among the mammalia, as had been previously supposed, but that the blood-corpuscles of the napu musk deer,* and probably of its congeners, are so singularly minute that their

* See London and Edin. Phil. Mag. for Dec. 1839, and Feb. 1840, p. 114. Dublin Med. Press, Nov. 1839.

average diameter is between $\frac{1}{14000}$th and $\frac{1}{12000}$th of an inch. It would, therefore, be interesting to examine the pus of an animal of this genus. In the meantime it may be mentioned that I found in the blood of the musk deer several large white spherical bodies, similar to those observable in the blood of other animals, and that the lymph globules did not differ in magnitude from those of mammals with large blood-corpuscles.

ON

WHITE SPOTS

ON THE SURFACE OF THE HEART,

AND

ON THE FREQUENCY OF

PERICARDITIS.

By JAMES PAGET, Esq.

Communicated by JOHN G. PERRY, Esq.

READ NOVEMBER 26TH, 1839.

The origin of the white spots so commonly found on the surface of the heart, has not yet, I believe, been satisfactorily illustrated. Many writers have indeed regarded them as effects of pericarditis,* but their extreme frequency, and the absence of any positive evidence in support of such an opinion, have hitherto opposed its general reception, and at present most pathologists would probably agree with the accurate M. Bizot,† that the nature of their cause is totally unknown.

* See Copland's Dictionary of Practical Medicine, Art. Heart, § 215.

† Recherches sur le Cœur et le Système Artériel chez l'Homme. —Mem. de la Société Med. d'Observation, V. I., p. 348.

The most common appearance of this affection of the serous covering of the heart, is that of one or more opaque, pearly-white spots, of a rounded or irregular form, of moderate density and consistence, and very slightly, if at all, elevated above the surrounding surface. These spots are sometimes not more than a line in diameter, but they vary in size, and often cover nearly the whole of one surface of the right ventricle or auricle; their most common width is about half an inch, and they are from half a line to two lines in thickness. They occur most frequently on the anterior surface of the right ventricle, and are often found tracking out the course of the trunks of its coronary vessels. They are rather more rarely seen on the posterior surface of the right ventricle, and on the right auricle; more rarely still on the left ventricle, and most rarely of all on the left auricle.

With these spots there almost constantly coincides some adhesion, by organized lymph, between adjacent parts of the pericardial membrane; and it is from this fact that I am led to regard them, in all cases, as the results of pericarditis.

The adhesions generally consist of slender threads passing across the furrow between the aorta and vena cava superior, or between the aorta and pulmonary artery at some little distance from their connection with the heart. In other cases, they are attached by one extremity to either of these vessels, and by the other to the opposite surface of the pericardium; and more rarely, though more distinctly,

a band of adhesion passes from one of the spots or from some adjacent part of the heart to the opposite surface. Lastly, there may be found only the indications of adhesions that had once existed, in the form of small pearly granules on the surface of the aorta or cava, and on the corresponding surface of the pericardium. In one or other of these forms adhesions may be found in nearly every case in which there is a white spot on the surface of the heart; they are often minute and difficult of detection, and though when once seen they are sufficiently distinct to leave no doubt of their origin, yet I have sometimes had to make so careful an examination to find them, that I have felt no surprise at their having been generally overlooked.

From the records of the cases which I have examined, I find that in 40 cases in which there were white spots on the heart, 35 have presented anormal adhesions, or their remains. In 5 cases only were the adhesions absent, and in 4 cases only an adhesion was found where there were no spots. In the 35 cases with adhesions, they were situated 23 times between the aorta and some other vessel, and 19 times between one of the great vessels and the opposite surface of the pericardium.

In four cases I have found a band of adhesion passing from the surface of a spot to the pericardium opposite to it; and my friend, Dr. Budd, tells me that he has twice seen a similar formation. In many cases also there is a distinct roughness or radiated puckering, like a superficial cicatrix, on the

pericardium opposite the spots. In these it is probable that the spots are indications of the pre-existence of adhesions; but in all other cases I should regard them as the effects of local and defined inflammation, which has been prevented from producing adhesion by the fluid simultaneously effused separating the serous surfaces, and permitting part of the lymph to sink down to the great vessels, while the rest remained on the surface and in the cellular tissue of the inflamed part.

The question often asked, whether these spots be seated in or on the pericardial membrane of the heart, is, I think, one which neither can nor need be definitively answered. According to the depth and degree to which the cellular or adipose tissue round the heart is inflamed, the lymph will be effused, either on its surface, (after the removal of the epithelium,) or in its areolæ, or in both situations; and in any case when it becomes organized, it will form a new epithelium on its free surface, and may therefore be said to be beneath the serous membrane. The spots are generally easily stripped off, but in no case after they are organized can they be separated from the subjacent tissue without dividing numerous connecting filaments, and leaving the surface from which they are removed flocculent and shreddy. The little patches of soft transparent and very easily separable lymph, which M. Bizot mentions, are, I believe, only an early stage of the same affection, in which the inflammation is chiefly superficial, and lymph is effused on the surface of

the membrane; at first it of course adheres but slightly; but subsequently, when vessels pass into it, it undergoes all the usual changes of effused lymph, and becomes opaque and adherent.

The reason of the adhesions which are coincident with these spots being so constantly found about the great vessels is, that in comparison with the walls of the heart, *they* are fixed and motionless, and present every facility for the adhesion and organization of the lymph that is effused, and which either gravitates to them in the recumbent position of the body, or is impelled thither by the currents which the action of the heart excites in the fluid around it. I have often seen that the lymph effused in a slight recent attack of pericarditis has settled around the great vessels; and it is commonly observed, that the last part in which a rubbing sound can be heard, in more severe cases, is in the line over the base of the pericardium, where the great vessels are connected with the sac.

If this explanation be correct, it would prove that adhesions do not necessarily mark the part at which the chief inflammation of a serous membrane has existed; and in this respect these cases of pericarditis are similar to some of peritonitis, in which, as Dr. Hodgkin* has remarked (and I have often had occasion to confirm his observation), it is probable that the adhesions so commonly found in the pouch between the uterus and rectum, are the result of

* Lectures on the Morbid Anatomy of the Serous and Mucous Membranes, vol. i. p. 157.

loose lymph, effused from some other organ, having gravitated to this situation.

But whatever explanation of the formation of the adhesions be received, both they and the white spots cannot but be regarded as the effects of inflammation of some part of the pericardium; and they prove a far greater frequency of that disease than has been generally imagined. The white spots are so common, that many writers, as Dr. Baillie, Dr. Hodgkin, &c., have considered that they could scarcely be regarded as the result of disease. It is often said, that they occur in half, or more than half, of those who are above the age of childhood. M. Bizot found them 45 times in 156 subjects; viz., in 31 out of 72 men, and in 14 out of 84 women; and I have myself found them in 45 cases out of 110; viz., in 32 out of 66 males, and in 13 out of 44 females. The proportions in which they are found in different ages is also, I believe, correctly stated by M. Bizot; but this calculation is of less interest when the affection ceases to be regarded as one of the changes commonly induced by age; because it is evident that the proportion of persons affected with pericarditis, or any other disease common to all ages, must increase with advancing years.

Including then the white spots among the effects of pericarditis, I find that of 110 cases which I have lately examined at St. Bartholomew's Hospital, 58 have presented signs of having suffered at some time from that disease. Among these, 40 out of

66 males, and 18 out of 44 females, were thus affected; and with respect to their ages, the morbid appearances were found in 5 out of 14 below twenty; in 25 out of 53 between the ages of twenty and forty; and in 28 out of 43 above forty.

Of these 58 cases of pericarditis, 49 were slight cases, marked by white spots and adhesions, or by effusion of small quantities of lymph; and 9 were severe, with complete adhesion, or with abundant recent effusion.

The subsequent effects of the slight cases of pericarditis are not appreciable. In none of them was there any disease of the heart, but such as was sufficiently accounted for by some other coincident affection, as disease of the valves, &c. In three cases of complete and close adhesion of the pericardial surfaces also, in which there was no coincident disease of the valves, the patients were engaged in active work, and died of affections over which the state of the heart had no evident influence. In two other cases of complete adhesion, the valves were diseased, and both these proved fatal; one in three years, and the other in a year after the first attack, which occurred in the course of rheumatism.

It is difficult to discover the causes of any disease from patients of the class among whom these examinations have been made, when it has not produced any effect appreciable to their senses. With respect, therefore, to the occasions on which these slight affections of the pericardium have happened,

I can give no sufficient information. I have several times seen slight pericarditis occurring as an accident of typhus fever; and I am inclined to think it may exist in the course of many acute diseases. Of the 66 males examined, 24 were known drunkards; and of these, 20 had had pericarditis; a proportion sufficient to prove that intemperance and its consequences are among the most powerful excitants of this disease. Phthisis does not appear to have any influence on its development.

REMARKS

ON

EMPHYSEMA OF THE LUNGS.

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Dr. Baillie was the first to describe methodically some of the principal anatomical characters of emphysema of the lungs; namely, increased volume of the lungs, absence of their natural tendency to collapse when the chest is opened after death, and dilatation of the air-cells.

The illustrious Laennec gave a much more complete description of this condition of the lungs: he also pointed out the signs by which it may be recognised during life, and engaged for it the attention of physicians, by showing that it is the most common cause of that group of distressing symptoms which is well known under the name of asthma.

Since Laennec's time, many physicians have improved our knowledge of this disease: M. Louis especially, by his accurate researches, has thrown light on its history and symptoms, and made us acquainted with its great frequency. To Dr. Stokes

also, we are indebted for valuable observations on the symptoms of emphysema: but little, however, has been added to our knowledge of its anatomical characters, which Laennec so well described. It is necessary to my present purpose to recapitulate the chief of these.

When we inspect the chest of a person who has died with extensive emphysema of the lungs, we remark that its form, instead of being flattened and depressed, as is usual after death, is more or less cylindrical; that the ribs have lost the obliquity which they naturally have in expiration, and that the depressions which commonly exist above the clavicles are wholly, or partially, effaced; in short, that the cavity of the chest is dilated—often much more so than in the most ample inspiration of healthy persons.

When the chest is opened, the lungs are found to be unnaturally voluminous, overwrapping one another, and in some instances displacing the neighbouring viscera. They do not collapse as in the natural state; sometimes, on the contrary, they protrude as the scalpel relieves them from the pressure of the parietes of the chest. They also offer great resistance to pressure, and are with difficulty deprived of the air they contain. On further examination, the increased volume of the lung is found to be owing to dilatation of the air-cells, and this alteration exists in a higher degree towards the borders of the lung, than elsewhere. When the lung is cut into, it is observed to be unusually dry and pale.

It is one of the chief objects of this paper to show that want of elasticity in the lung—in other words, absence of its natural tendency to collapse,—is the cause of many of the other anatomical characters of emphysema, and of most of the symptoms by which this affection is recognised. In order to show this more clearly, I shall first give a general idea of the act of breathing in its natural state. In natural breathing, when the expansion of the chest has attained its limit, and inspiration is complete, a quantity of air, equal to that which has been inhaled, is again expelled; chiefly, if not wholly, by means of the elasticity of the lung, which restores that organ to the volume it had before inspiration. The *muscles* and parietes of the chest do no more than follow the lung in its collapse. In every other respect they are passive. The elasticity of the lung is the main agent of expiration. That this property of the lung is more than adequate to accomplish that action is proved by the fact, that when the chest is opened after death, and the atmospheric pressure tending to compress the lung is, consequently, equal to that which tends to dilate it, there ensues a still further expulsion of air from the lung, effected by the residual elasticity of that organ—so that the only cause which, during life, prevents more complete expiration than does actually take place, is the inability of the parietes of the chest to follow further retrocession of the lung. When, therefore, the lungs have their natural tendency to collapse, the amplitude of the act of inspiration varies with

the degree to which the parietes of the chest can follow them in their retrocession; and this degree evidently depends in great measure on the obliquity of the ribs. In man different degrees of obliquity of the ribs are rarely noticed; but the sportsman is well aware of the influence of this circumstance on the speed of his horse and his dogs. In fleet animals, indeed, the obliquity of the ribs is very considerable, and is well exemplified in the deep, keely, chests of the grey-hound and the race-horse.

These points being established, I proceed to consider some of the consequences of the absence of the natural elasticity of the lung, which, as we have seen, constitutes one of the principal anatomical characters of emphysema.

One of the first effects of this condition is, that the lungs, and with them the parietes of the chest, do not collapse as they should do in expiration; the powerful muscles of inspiration are continually acting to elevate the ribs and dilate the chest, and have not their natural antagonist. The chest becomes, in consequence, permanently dilated; often beyond the limit attained in the most ample natural inspiration. It is the permanent elevation of the ribs that gives to the chest the cylindrical form, and, by raising in turn the shoulder-blades and collar-bones, that produces the high shoulders of asthmatic persons.

When this conformation of the chest is attained, its capacity cannot be much further increased by the action of the muscles, which raise the ribs. This

circumstance gives a peculiar character to the breathing of persons affected with emphysema; the ribs being permanently raised by the dilatation of the chest, the increased capacity of that cavity which takes place in inspiration is mainly effected by the diaphragm, and the respiration is abdominal. It is owing to this circumstance that the erect posture is more necessary to asthmatics than to persons affected with pleurisy or pneumonia, in whom the respiration is of equal, or even greater, frequency; and that dyspepsia, by causing flatulence and distension of the stomach, and so opposing the descent of the diaphragm, is so often the cause of a fit. The attack of the paroxysm in the night—a peculiar feature of asthma—seems to result, not from the state of sleep, but from the horizontal posture, which causes impediment to the descent of the diaphragm. The abdominal character of the breathing is still further increased by the circumstance that the portion of lung in contact with the diaphragm is not so subject to emphysema as others. This character of the breathing is very conspicuous in horses affected with emphysema, on account of the shortness of their flanks, and is well known to horse-dealers as a sign of broken-wind.

I have said that the ribs are permanently much raised: they have, therefore, little or no space to move through in inspiration, and consequently remain almost fixed. Nothing is more striking than the contrast which may be observed in a severe fit of asthma between the labouring for breath, the

active play of the nostrils, with other marks of extreme dyspnœa, and the comparative immobility of the chest.

The modification which this affection of the lungs produces on the act of coughing is also well worthy of attention. It is plain that coughing, which is nothing more than a rapid succession of sudden and forcible expirations, must be impeded in the same way as common expiration. If we observe the cough in asthma, we perceive that the parietes of the chest are little affected by it, and that it is short and interrupted; a circumstance the more distressing because the catarrh, to which persons affected with emphysema are habitually subject, is attended with a copious secretion from the bronchial membrane. The efforts of cough being ineffectual, and the irritation of the mucus remaining, the cough repeats itself in fits. Thus, in this distressing complaint, not only is less air than natural admitted to the internal surface of the lungs, but that surface is also sheathed from its action by a copious secretion which the cough is inadequate to detach: it is on account of this combination of circumstances that difficulty of breathing attains in asthma a degree which is seldom equalled in other affections. From this it follows also, that catarrh is the great enemy of persons affected with emphysema of the lungs, and that it is in this disease, especially, that we may hope for signal advantage from the effects of appropriate climate.

The preceding remarks apply chiefly to those ex-

treme cases, in which, when the chest is opened after death, the lungs protrude; in which it is, therefore, evident that, during life, expiration must have been wholly effected by pressure from without. In less advanced cases, when the emphysema has not attained a sufficient degree to add considerably to the volume of the lung, or to oppose its retrocession to that limit beyond which the parietes of the chest cannot follow it, it is evident that emphysema cannot be a powerful cause of difficulty of breathing in the way I have explained above. The truth is, that in these cases the difficulty of breathing is not great. When, however, the emphysema is partial, and the portions of lung affected have completely lost their elasticity, the explanation above given will apply perfectly to those portions. They will not collapse during expiration, and the corresponding parietes will become permanently raised. The air also which these portions contain will be very imperfectly renewed: in fact they will contribute little to the act of breathing, which will be performed almost entirely by the rest of the lungs. When a lung that is partially emphysematous is artificially inflated, the emphysematous portions increase in volume much less than the others, and, from being prominent when the inflation was begun, those portions do not exceed the level of the rest when that process is completed.

One obvious effect of the want of action in these emphysematous portions is, that the air produces little sound in entering them; a circumstance which

explains the feebleness of the respiratory murmur, which is a well-known sign of emphysema.

Not only is an insufficient quantity of air inhaled into the emphysematous portions, but also, and for the same reason, less blood than natural flows to meet it. Laennec, in his description of emphysematous lungs, makes the following statement: "The pulmonary tissue is less moist in an emphysematous than in a sound lung, and you cannot find in the former, even towards its root, any trace of serous or sanguineous congestion."

Cases the sixth and seventh, in the first volume of his work on diseases of the chest, afford such striking illustrations of this, that I may be excused for giving an abstract of them.

The sixth case is that of a man affected with asthma and slight anasarca; who, while in the hospital for the treatment of these complaints, was cut off by small pox. In the last days of his illness he experienced great difficulty of breathing.

The following is the description of his lungs. "The lungs were without adhesions. They completely filled the cavity of the chest, and seemed to be compressed by its parietes. They did not collapse in the least on the admission of the external air. Their tissue was dryer than natural: in a few points only, which were less emphysematous than the rest, and situated in the centre or towards the root of the lungs, a small quantity of serous fluid, very frothy and slightly tinged with blood, oozed from the surfaces exposed by incisions."

The seventh case is still more striking. It is that of a man who died of emphysema of the lungs with pulmonary catarrh. There was orthopnœa in the last days of his illness, and his death seemed to result from suffocation.

When the lung was cut into, there was less crepitation than usual, and neither blood nor serum oozed from its tissue; which everywhere, except towards the root of the lung, was dryer than that of the most healthy lung. The bronchi were very red, and filled with a white, tenacious mucus.

To these cases I may add the following, which came under my own notice. In the winter of 1837 a man was admitted into the Dreadnought, affected with general emphysema of the lungs and pulmonary catarrh. He died in a state of asphyxia soon after admission.

The lungs were found extremely dry and pale; there was dark blood in the large veins of the lungs; but, except from these, scarcely a drop of blood escaped when free incisions were made in all parts of the lung. There was no pneumonia; but the small bronchial tubes contained yellow puriform mucus.

These cases are very striking; for what can be more remarkable than to find paleness, dryness, and absence of congestion in the lungs of persons who have died in a state of asphyxia; the well-known and most marked effect of that condition being the greatest possible congestion of the lungs! The conclusion is, therefore, peremptory, that during life

the natural vascularity of the lungs, at least as regards the pulmonary artery, was much diminished. This restriction is necessary; since, in the cases referred to, the bronchial membrane was red and turgid. The coincidence of the pale, aneuric condition of the pulmonary tissue, with the congested state of the mucous membrane of the bronchial tubes, in the same lung, is worthy of observation, as showing an essential difference between bronchitis and pneumonia—a difference which has its origin in the different purpose and distribution of the bronchial and pulmonary arteries.

The following case proves still more decisively the truth of the foregoing considerations.

In the month of October 1837, a man was admitted into the Dreadnought, affected with cough, difficulty of breathing, and loss of voice. The soft palate had been destroyed many years before by syphilitic ulcerations, which were now quite healed. There was a large cicatrix in the pharynx. He was much emaciated. Some time after his admission he was attacked with double pneumonia, of which he soon died.

The lower lobes of both lungs were covered with a thick coating of lymph. They were hepatized throughout, except a broad rim at the edges, which was emphysematous, and was the only portion of the lower lobes not solidified. The dry, pale, and light emphysematous border contrasted strongly with the great mass of the lower lobes, which was solid, heavy, friable and granular. The upper lobe

of the left lung was very emphysematous, and perfectly dry; it was a complete puff. (There were no tubercles.) The trachea below the larynx was contracted to the size of a large quill; the cicatrix resembled that which follows a burn.

In this case the emphysema had protected a large portion of the lung from pneumonia, and this protection must have been owing to diminished vascularity. That portion of the lung did not collapse during expiration; the air within it was not changed: in fact its function was no longer performed, and, as in fœtal life, no blood flowed there to be aerated. This fact affords an illustration of a law in physiology; that the tissue by which a function is performed becomes atrophied when that function ceases or becomes less active.

Congestions and the inflammatory affections of the lungs have been well studied; but I am not aware that any anatomist has bestowed steady attention on the remarkable diminution of vascularity which takes place in those portions of lung which have become emphysematous: yet this diminution of the capillary circulation (of the pulmonary artery), often in a considerable portion of the lung, is very remarkable in an organ whose function it is to expose all the blood in the system to the action of the air.

One effect of this condition of the lung is imperfect arterialization of the blood, and, consequently, diminution of animal heat. In the patient whose case I have already mentioned, who died in the

Dreadnought, of emphysema and bronchitis, this diminution of the temperature of the body was very remarkable. During the time he lived after his admission, his nose, lips, and tongue were cold, like those of a person in cholera.

Another consequence of this diminution of the capillary system of the pulmonary artery, is obstruction to the circulation through it: whence arise dilatation of the right cavities of the heart, and the tendency to general œdema, which is so frequently met with in emphysematous persons.

I have already alluded to the occurrence of emphysema in horses, and to its being in them, the cause of the symptoms so familiar to horse-dealers by the name of broken-wind. I have at present before me an account of the state of the lungs in twenty horses, of various ages, that were killed by the knackers. In these dissections, which were made in reference to this subject, the following circumstances were remarked.

In all, except two, the lungs were more or less emphysematous. The dilatation of the cells followed exactly the same order as in man, affecting chiefly those on the borders of the lung. The naturally thin edges of the lung were by reason of this, much thickened and rounded, and very frequently presented lobular appendices, formed by groups of cells dilated to the size of swan-drops. The anterior lobe, which in horses is a long, tongue-shaped, flap of lung, was always more affected with emphysema than any other part, and it was that lobe which so often pre-

sented the lobular appendices alluded to. Large vesicles under the pleura, filled with air and communicating with the bronchi, were observed in many instances. The emphysematous portions, as in man, were pale and dry, and remarkable for their great want of vascularity. The lobes most affected were much increased in volume; but in no instance did the lungs completely fill the chest. It must not be forgotten, however, that these horses did not die of the disease.

M. Louis found lobular appendices in man, in three only of forty cases of emphysema; whereas they were present in all but three of the twenty horses examined. Most of these horses were out of mark and old; but three of them were young, and in these the affection was less advanced than in the others.

From these observations I conclude that emphysema of the lungs is very common in horses; that in them its development follows in all particulars the same order as in man; and, therefore, that the affection has probably the same cause in both.

The investigation of the causes of emphysema of the lungs in man has furnished Mr. Jackson with novel and unexpected results. Of twenty-eight persons affected with emphysema of the lungs, he found that eighteen were the offspring of parents (father or mother) affected with the same disease, and that several of these had died in its course. In some instances, the brothers and sisters of these persons were also emphysematous. On the other hand,

of fifty persons not affected with emphysema of the lungs, three only were the offspring of emphysematous parents: whence it follows that emphysema is very frequently an hereditary disease. I need not dwell on the interest of this fact as regards man, but I would point it out to the breeders of horses as one of great importance, for there can be little doubt that the disease is transmitted in the same way in the horse. It is undoubtedly owing to ignorance or disregard of this fact, that broken-wind is so common, even in young horses.

Laennec, in his examination of emphysematous lungs, being much struck with the dilatation of the air-cells, a circumstance which so readily admits a mechanical interpretation, supposed that this affection was in every case produced by some obstruction in the air-passages, which prevented the free escape of air from the lungs; and that bronchitis, by the secretion with which it is attended, is the most common cause of this obstruction. He imagined that when the bronchial tubes were obstructed with mucus, the powerful muscles of inspiration would overcome the resistance which this mucus would offer to the entrance of air into the lungs, but that the elasticity of the lung, which is the chief agent in expiration, would be inadequate to effect its expulsion; and that the cells would in consequence be permanently dilated. This explanation, which accounted in such a plausible manner for the dilatation of the cells, was admitted by all physicians, until doubts of its correctness were excited by the

discovery made by Mr. Jackson of the hereditary nature of emphysema. The accurate researches of M. Louis have confirmed these doubts. He found that emphysema often developes itself without the occurrence of pulmonary catarrh; that very frequently it is not sensibly increased by a severe attack of this malady; and that the highest degree of emphysema is met with in the upper lobe, and at the edges of the lung, while acute catarrh is most common and most severe in its lower and posterior part. He concludes from these facts, that if catarrh have any influence on the development of emphysema, this influence is slight, and but rarely exerted. His observations show also that pneumonia has no influence in producing emphysema: that persons are not unfrequently met with who have had many attacks of pneumonia, but do not exhibit any of the symptoms of emphysema, and that emphysema already existing is often not sensibly increased by an attack of pneumonia. From these circumstances he is led to reject entirely the supposition which ascribes the dilatation of the cells to a mechanical cause. Thus Laennec, considering dilatation of the cells as the essential character of emphysema, explained it by a mechanism similar to that which causes the dilatation of other hollow organs; namely, an obstacle to the free escape of their contents; and Louis, finding that in a great number of instances no such obstacle existed, in the sense in which it was understood by Laennec,

has been induced to deny that the dilatation is caused by mechanical means.

Laennec was right in supposing that dilatation of the air-cells is occasioned by an obstacle to the free escape of their contents; but he was wrong in believing this obstacle to exist generally in the bronchial tubes. Louis was correct in stating that emphysema often comes on without the previous occurrence of bronchitis; but he was, I believe, in error, when he ascribed dilatation of the air-cells to a cause different in its nature from that which produces dilatation of other organs. Dilatation of the air-cells, like dilatation of the chest, is a necessary consequence of want of elasticity of the lung. The powerful muscles of inspiration are continually acting to dilate the chest, and thence, by virtue of atmospheric pressure, the air-cells. This agency is not counteracted as it should be, by the natural elasticity of the lung; and the air-cells, as well as the cavity of the chest, are in consequence permanently dilated.

I have already shown that the other anatomical characters of emphysema, together with most of the symptoms of this disease, result from the same cause; and I am, therefore, led to consider the absence of elasticity* of the pulmonary tissue as the funda-

* Magendie ascribes the difficulty of breathing in emphysematous persons and in broken-winded horses, to want of elasticity of the lung, but he does not attribute the dilatation of the air-cells to the same cause: on the contrary, he says, "par suite de la rupture d'un certain nombre de cellules, et de la dilatation d'un certain

mental character and primary condition of emphysema of the lungs.

The preceding remarks suggest some considerations on the subject of asthma.

Asthma has been generally ascribed to constriction of the small bronchial tubes, in consequence of spasm of the circular fibres which surround them, and which have been supposed to be muscular.

There is reason, however, to believe that these fibres, like those which compose the middle coat of arteries, are not muscular; but that they are simply fibres of elastic tissue. The bronchial tubes resemble the arteries in this, that they are cylinders destined to the passage of a fluid. Now it is evident, from the property which fluids have of propagating pressure equally in all directions, that muscular fibres surrounding these cylinders would have equal effect to propel the fluid backwards and forwards; and, consequently, would tend to dilate the air-cells, as much as to expel air from the trachea. They would not, therefore, contribute much to the act of expiration. The supposition of muscular fibres in the lungs for the purpose of expiration is, besides, perfectly unnecessary; all that is required of the lungs for the accomplishment of this act is, that they should collapse readily. Now lungs not em-

nombre d'autres, le tissue de l'organe a perdu de son elasticité, et il ne reagit plus avec une energie suffisante sur l'air qui a penetré dans son parenchyme." Leçons, t. i. p. 169.

physematous," collapse when the chest is opened many hours after death, (in fact until decomposition has taken place,) as completely as immediately after death; and generally to a much greater degree than the parietes of the chest can follow them. It is evident that no part of this collapse can be owing to muscular action, since, in Mammalia, muscular irritability ceases within an hour after death; and no part of it can result from atmospheric pressure, because, when the chest is opened, the atmospheric pressure acting on the external surface of the lung, and tending to compress it, must be equal to that acting within the lung, and tending to dilate it. The elasticity of the tissues which compose the lungs must, therefore, be the sole cause of their collapse, when the chest is opened many hours after death, and this elasticity is consequently more than sufficient, in healthy lungs, for the purpose of expiration. It is difficult to conceive that muscular fibres surrounding the bronchi, could in any way contribute to the act of inspiration: so that for ordinary breathing, there is no need of a muscular power in the substance of the lungs.

On the other hand, an elastic tissue is required in the bronchial tubes, as well as in the arteries, to counteract the force which acts periodically to expand them.

During inspiration, atmospheric pressure is removed from the surface of the lung by the muscles of inspiration, the air rushes into the chest, and

tends, by its expansive force, to dilate the bronchial tubes and air-cells. This tendency is counteracted in the larger bronchial tubes by cartilaginous rings, and in the smaller ones, where less strength of material is necessary, by elastic circular fibres. It is the loss of elasticity in certain portions of these tubes from disease, that is the most common cause of dilatation of the bronchi. Although the muscularity of these fibres has been long maintained, and, since the time of Cullen, has been adduced to explain the symptoms of asthma, either by supposing, with Cullen, the spasm of these fibres, or, as an eminent living physician has preferred, their paralysis, very few attempts have been made to demonstrate the existence of this muscularity. In order to satisfy my mind on this point, I performed, with the assistance of my friend Mr. Busk, the following experiments.

A rabbit, between two and three months old, was killed by a smart blow behind the ears. As soon as its struggles were over, the trachea was taken out, and the anterior part of the cartilaginous rings removed by the scissors, in order that any motion produced by the transverse fibres at its posterior part might be more readily seen. When a portion of the trachea, thus prepared, was placed on a plate, not the slightest movement could be seen in it, nor could any be excited by the wires of a galvanic battery. One of the lungs was then removed, and placed on the plate, between two and three minutes after the struggles of the animal had ceased. The end of the bronchi in which the lung terminated, was

obstructed by light froth. No motion could be observed in this froth, or in the lung, before or after the wires were applied to different points on the surface of the lung, neither could any motion be perceived, when the lung was cut into, and the extremities of the wires were placed near one of the bronchial tubes.

The abdomen was opened at the end of five minutes, when the muscular fibres of the stomach and intestines were seen to contract slowly, but very distinctly, under the galvanic influence. At the end of ten minutes, these contractions were no longer perceptible; but vigorous contractions could still be excited in the heart, and in the muscles of the larynx.

Another rabbit, of the same age as the former, was killed in the same manner; one of the lungs was taken out as quickly as possible, and placed on the plate. Not the slightest movement could be observed in it, nor could any be excited by placing the wires of the battery at different points of its surface, or in contact with the bronchial tubes. The trachea was then removed, and treated as in the former experiment, and with the same result. The abdomen was next opened, the intestines were moving from peristaltic action. The muscles, both of the intestines and of the stomach, which was distended, contracted very distinctly when galvanism was applied. At the end of ten minutes from the death of the animal, these contractions were no longer discernible; but more than half an hour after,

contractions could be excited in the heart, and in the muscles of the larynx.

The galvanic trough employed contained fifty pairs of copper and zinc plates. The solution used was a mixture of muriatic acid and water. The chemical action of the battery was powerful, causing ecchymosed spots on the surface of the lung at the points to which the wires were applied; and opaque white spots, from coagulation of albumen, at those points of the peritoneum which were touched by the wires.

Among the older authors who made experiments to ascertain the muscularity of the bronchial tubes, Varnier is most frequently quoted. His experiments consisted in injecting chemical irritants, chiefly the mineral acids, into them. The constriction which he noticed in the small bronchial tubes as a consequence of this injection is attributable to chemical changes produced in the texture of those tubes, and cannot be adduced as proof of their muscularity.

In recent times, Wedemeyer has made experiments for the same purpose. I have been unable to refer to the work in which he has recorded these experiments, but the following is the account given of one of them by Müller. "Wedemeyer laid bare the trachea in a living dog, and freed it from cellular tissue for the space of two inches: he then cut out a portion in front, and irritated the posterior wall of the trachea mechanically and by galvanism, but could not produce the slightest contraction. Wedemeyer now opened the thorax quickly, and

removed the lungs with their bronchi. He made several sections of the larger bronchi, but could discover no sign of contractility in them. On applying galvanism, however, to the smaller branches of about one line in diameter he thought he saw them undergo a distinct contraction, but it took place very slowly." This experiment of Wedemeyer, as far as the trachea and larger bronchi are concerned, agrees with those that I have before related: and together they seem to establish that no contractions can be excited in those tubes by galvanic influence. This point, if admitted, affords an almost conclusive argument against the muscularity of the smaller tubes. For the transverse fibres in the smaller tubes have the same arrangement as in the larger, and we cannot suppose them to be of different nature without admitting a break in the law of continuity. The resemblance of the transverse fibres of the bronchial tubes to the muscular fibres of organic life—the chief argument in favour of the muscularity of the former—is certainly more striking for the fibres in the larger than for those in the smaller bronchi. The contraction witnessed by Wedemeyer in tubes of a line in diameter, resulted in all probability from chemical changes, especially the coagulation of albumen, caused by the galvanic influence. Such changes were very manifest in my own experiments. The manner in which I performed the experiment, by placing the wires, not in contact with one of the small bronchial tubes, but at different points on the surface of the lung, affords

a much more delicate test of the muscularity of the bronchi. If these were muscular, a great number of them would be excited at once when the wires were placed on the surface of the lung and the galvanic influence diffused through its mass: and their combined effect would be visible in movements of the surface of the lung, or of the froth obstructing the orifice of the terminal bronchus.

I might conclude, then, from the preceding observations and experiments alone, that the transverse fibres of the bronchi have been wrongly supposed to be muscular. But it can be shown from other and independent considerations, that these fibres are not muscles, performing a part in the ordinary acts of breathing. Supposing them to be muscular, it is evident from their arrangement and microscopic characters, that they belong to the muscles of organic life, or that they are involuntary muscles. But all the external muscles of respiration are voluntary muscles. Hence we should have engaged to accomplish the act of breathing, a voluntary and an involuntary power. The function would be easily performed as long as these powers acted in unison—that is, as long as the involuntary muscles contracted only during expiration. But, by varying the rapidity of our breathing, we should soon have the two powers opposed to each other—the involuntary muscles acting to close the bronchial tubes, while the voluntary muscles acted to expand them. We should then be able to dilate the chest only when we adjusted the inspiratory movements to the

actions of the involuntary muscles. But we perceive no necessity for such an adjustment. The test, which this circumstance affords us, is one of extreme delicacy. For, if the two powers were not *exactly* in unison, there would occur intervals, like the *beats* in music, when they would coincide or be opposed to each other. The inspiratory acts would be alternately easy and difficult, according as the voluntary and involuntary muscles were in the same or in opposite phases. But, however rapid we make our breathing, we perceive no difference in the ease with which successive acts of inspiration are performed. This circumstance is a proof the most decisive, that the fibres of the bronchi have no independent rhythmical motions of contraction; and if we suppose them to contract only after the tubes have been expanded, we attribute to them an office for which simple elasticity would be perfectly adequate.

The idea of spasm of the bronchi was suggested to Cullen, and has been generally adopted, from inability to explain in any other way the symptoms of asthma. A little consideration, however, is sufficient to show the improbable nature of this supposition. The large bronchial tubes, and, in man, those even of the fourth and fifth ramifications, cannot be closed by reason of the cartilaginous rings or plates, which wholly or partially surround them. Supposing, then, the circular fibres to be muscular, only very small bronchial tubes could be closed by their action; and the closing of a few of

those tubes would only obstruct the passage of air to the small portions of lung to which they lead, and would not cause much difficulty of breathing. The spasm, to explain the symptoms of asthma, must be supposed to affect the small bronchial tubes in a considerable portion of the lungs; and as, in almost all cases of asthma, some shortness of breathing remains, in the intervals of the fits, we must admit, and, in fact, most physicians who have written on the subject have admitted, that some degree of spasm is permanent.

The necessity of such a supposition has, in great measure, ceased, in consequence of modern discoveries in morbid anatomy. Corvisart first pointed out diseases of the heart and large vessels as an occasional cause of fits of dyspnœa, formerly regarded as nervous, and confounded under the name of asthma. Laennec, and more recently Louis, have shown that emphysema of the lungs is the most common cause of this group of symptoms, and that the physical signs of dilatation of the air-cells may be discovered during life in most persons who present the symptoms of asthma.

Many of these persons can vary the capacity of their chests to a degree only just sufficient to supply them with the requisite quantity of oxygen, in favourable circumstances. Whenever their circulation is quickened, by exciting passions or by exercise,—or their power of expanding the chest is a little diminished, by the obstacle which a distended stomach offers to the descent of the diaphragm,—

or the air is prevented from freely entering the air-cells, in consequence of secretions in the bronchial tubes,—or the proportion of oxygen in a given volume of air is diminished; whether by increased temperature, as in heated apartments, or by diminished pressure, as in elevated situations, and in those states of the atmosphere which precede storms:—in fact, whenever, from any cause, their need of oxygen increases, or their means of inhaling it diminishes, these persons experience difficulty of breathing, or a fit of asthma.

There still, however, remain some cases, which at present we can only explain by supposing the dyspnœa to be nervous. It seems probable that the number of such cases will be still further diminished, and that many of those fits of asthma, which we are now forced to consider nervous, will be discovered to depend on some organic change which has as yet escaped our observation, perhaps on some morbid condition of the blood itself.

In fits of asthma really nervous, the difficulty of breathing must result from spasm, or from suspension of the normal action of the diaphragm and other muscles of inspiration.

ON

A REMARKABLE EFFECT UPON THE HUMAN GUMS

PRODUCED BY

THE ABSORPTION OF LEAD.

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READ JANUARY 14TH, 1840.

No branch of medicine is perhaps of greater importance than that which contemplates the means employed in the prevention and cure of diseases. But notwithstanding a vast number of observations have been made with a view of ascertaining the medicinal efficacy of various substances, and many well-regulated experiments instituted, yet the sum of the information resulting from these inquiries is small in comparison with the labour bestowed in collecting it, and our knowledge of the virtues of medicines still continues very imperfect. Nevertheless, the histories of cinchona, iodine, mercury, and antimony, offer proofs of the benefit which has been already experienced from the discovery of new medicines, and afford a reasonable expectation that ad-

ditional improvements in the treatment of disease will emanate from future discoveries.

The opinions however of therapeutists differ very widely in respect of the virtues of the same medicine, and it was whilst endeavouring to confirm or refute the statements published with reference to the action of lead on man, that I noticed an interesting phenomenon which, so far as I can ascertain, has not been hitherto recorded: and, as I believe it will prove useful in the treatment of disease, I hope the following references to it will deserve the favourable consideration of the Royal Medical and Chirurgical Society.

Medical authors have stated, that a salivation is occasionally produced by the action of lead, introduced in a very comminuted form into the human body. Dr. R. Warren, in an essay read before the Royal College of Physicians in 1768, gives (Med. Trans. vol. ii, p. 87.) an account of "Four persons out of thirty two, who were attacked by lead colic, and fell into salivations for several hours every day, and said their pain was abated by the spitting." Dr. Christison also, speaking of the action and symptoms of lead on man, (Treatise on Poisons, 1829 and 1836,) says, "The saliva is increased in quantity, and bluish in colour."

Dr. A. T. Thomson likewise states, (vol. ii. Therapeutics, p. 64.) "The saliva assumes a bluish colour." But these very eminent authorities have not, I believe, noticed the peculiar discolouration on the gums, produced by lead, which it is the chief object

of this paper to describe. My attention was first directed to the phenomenon in the year 1834, when a patient under the treatment of my friend and late colleague, at St. Thomas's Hospital, Dr. Roots, was said to have been salivated by the internal use of acetate of lead; and from that time I have been accustomed to examine the mouths of patients admitted into my wards, who had been exposed to the action of lead in the course of their usual avocations; and of those also who had swallowed the acetate of lead medicinally. The result of this investigation has proved highly interesting. It has led to the belief that a salivation in the ordinary sense of the word does not occur in one case out of thirty-six cases of lead colic, the number examined in my wards; nor in one case out of fourteen cases of pulmonary disease, which were treated by me with acetate of lead; but in the total number of fifty patients who were examined whilst under the influence of lead, a peculiar discolouration was observed on their gums, which I could not discern on the gums of several hundred patients, who were not under the influence of lead, and which I believe cannot be produced by any other internal remedy.

I believe the sign will enable physicians to establish with increased facility a precise diagnosis in derangements of health, depending on the unsuspected presence of lead; and also to obviate, in many cases, the infliction of lead colic, during the treatment of other diseases by saturine preparations.

The discolouration was carefully observed on fifty

patients, and although it varied a little in point of intensity as well as extent, yet the following description will apply with sufficient accuracy to the majority of cases in which it was remarked. The other phenomena referrible to the state of the mouth, noticed on these patients, were neither peculiar, nor invariably present. The edges of the gums attached to the necks of two or more teeth of either jaw, were distinctly bordered by a narrow leaden-blue line, about the one-twentieth part of an inch in width, whilst the substance of the gum apparently retained its ordinary colour and condition, so far as could be determined by comparing the gums of these patients with those of other patients of the same class in the hospital: there was no invariable tumefaction, softening or tenderness about them; neither was there any peculiar fœtor in the breath, nor increased salivary discharge to be observed on any of the fifty patients; and on thirteen out of fourteen patients, who were treated in the hospital with acetate of lead, and carefully watched during its employment, the substance of the gums, the smell of the breath, as well as the quantity and colour of the saliva, preserved the same characters, after the appearance of the blue line, as they respectively possessed before the saturine preparation was administered; but on the fourteenth patient, who died from hæmoptysis, the gums, which were, previously to the use of lead, tumid and soft, became contracted and firm, after the blue line had appeared.

With reference to the state induced by lead, it should be remembered, on making an examination of the mouth, that the gums and breath of patients who frequent hospitals (and by whom the practice of cleansing the teeth is habitually neglected,) very often present an unhealthy aspect, independent of constitutional disease arising from lead; and amongst the fifty patients who were examined under the influence of this metal, as well as others not under its influence, the gums of many were either ulcerated, tumid, or partially detached from the teeth by incrustations; but even on the patients with ulcerated gums, the peculiar leaden-blue border line was distinctly visible. I do not remember to have seen one example of the bleeding tumified gum, peculiar to confirmed scorbutus, produced by the internal use of lead; nor do I think it consistent with experience or reasonable, to suppose that a powerful and very useful astringent in hæmorrhages should simultaneously check hæmoptysis, and produce bleeding and tumid gums. The colour also of the scorbutic gum differs from the blue colour produced by lead, and there is likewise a peculiar fœtor in the breath of scorbutic patients with bleeding gums, which did not exist in the fifty patients above alluded to.

Neither is the state of the gums and salivary glands induced by mercurial preparations, similar to that produced by those of lead; for in fourteen cases of pulmonary disease treated with the acetate of lead, no pain, heat, redness or tumefaction of the gums,

characteristic of the action of mercurials, were observed; nor was there any increased flow of saliva, nor looseness of the teeth, notwithstanding the blue line was evident on the gums of all the fourteen patients. On the contrary, the blue line was obliterated on some patients with lead colic, to whom calomel was administered in quantity sufficient to affect the system.

I am bound however in fairness to state that "turgidity of the gums" is said by Dr. A. T. Thomson, to supervene large doses of acetate of lead; and also that my friend Mr. Moyle of Chacewater has attributed to the action of the same salt, a slight enlargement of the submaxillary glands and a tenderness in them when submitted to pressure; but in no case could he detect any increased salivary secretion; and he further remarks that in one case the gums were firm and dry, and rather pale excepting at their edges, where he observed the blue line. I do not wish to assert that salivation and turgidity of the gums are never produced by the internal operation of lead; but I venture to affirm they are rare occurrences, and not characteristic of its influence. On the other hand, the discolouration is a very constant occurrence; it precedes all other unequivocal symptoms produced by lead, and is not equally exposed to the imputation urged against most medical data, of being fugitive and deceptive. For the discolouration is very permanent; it has endured through months and until death, and having been once observed may be afterwards easily recognised. On a few patients

only had it entirely disappeared before they quitted the hospital; on others it had only partially vanished. In many it continued with little or no change; and on a few patients who died after the medicinal use of lead had affected their gums, the discolouration appeared more distinct a few hours after death, and before putrefaction could have began, than during life. It cannot be confounded, when distinct, with the ordinary colour of the gums, during life; and after death, any ambiguity which might have existed previously will be entirely removed by the strong contrast of colours disclosed on the gums of the dead body. The pathognomic value of the discolouration will bear a proportion to the regularity of its appearance under similar conditions; and in some cases, a little ambiguity may arise from the difficulty of discriminating between imperfectly defined colours; but this ambiguity will soon cease if the patient continues exposed to the action of fresh portions of lead; and in all cases the phenomenon will possess some importance if viewed in connexion with the ordinary symptoms of the presence of lead.

I have frequently experienced the utility of examining the gums, and in confirmation of my assertion I may add, that the gums of fifty-four patients, men, women, and children, were examined purposely on the same day, to detect this discolouration; but on fifty-two, nothing remarkable was noticed; on the remaining two patients however, the peculiar blue line was unexpectedly observed, and served in both cases to establish a precise diagnosis.

One of these patients had worked in a white lead manufactory three months previous to his admission into the hospital; the other in a glass-house; and on both there was a slight paralysis of the wrists, which had been overlooked by myself, and disregarded by the patients themselves at their first examination.

Two other patients, on whom the discolouration was extremely well developed, were subsequently treated by me, but they were unable to give any satisfactory account of having ever been exposed to the action of lead, although they exhibited the common symptoms which are generally attributed to the influence of this metal, as well as the blue line; and both cases deserve further notice in illustration of its therapeutic utility.

The first of these two latter patients was a carpenter. He had never worked in lead, nor had he any suspicion of having been exposed to its influence; but he had experienced a severe illness about four years before his admission into the hospital, which had been followed by a partial paralysis of the fingers of his left hand. In other respects his health was restored, and continued good until a few weeks before he was placed under my care; he then began to feel languid, and to experience a sense of weight about the limbs; his appetite failed, and subsequently he suffered a pain in the stomach, which extended upwards over both breasts to the shoulders and down the arms; the bowels had been constipated for a week previous to his admission, and during

this interval vomiting had several times occurred. His nights had been passed without sleep ; his pulse was 96, soft and regular, his skin warm, his countenance pale. In addition to these symptoms tremors were noticed in both hands when the patient extended his arms, and the gums were very distinctly marked with a leaden-blue border line. The combination of symptoms in this case was such as indicates lead colic and paralysis of the wrists ; but in what manner lead was introduced into the system could not be ascertained.

The second patient was a cordwainer, who had, until his admission, resided in the country. The features of this man were sallow ; he was spare, entirely free from paralysis of the voluntary muscles, but he had experienced for several years, at intervals, repeated attacks of colic, by which he had been confined to his bed seventeen times. During these attacks he had endured violent pains in the abdomen, frequent vomiting, and obstinate constipation, sleepless nights and loss of appetite. The gums of this patient were rather turgid, although not more so than nine-tenths of the gums of those patients who resort to hospitals ; they were also very well marked with the peculiar blue line, but no other evidence of the patient having been exposed to the action of lead could be obtained. I believe however, notwithstanding the absence of demonstrative proof, that this patient, as well as the former, was under the deleterious influence of lead. I admit, nevertheless, that reasonable objections may be raised

against the validity of the evidence on which this opinion rests; but when the assemblage of symptoms noticed on both patients is compared with that which can be produced by the internal use of acetate of lead, the evidence is almost as conclusive as the nature of medical investigations will admit; for although neither of these patients could give a cause for his illness, yet the supposition that both of them were under the influence of lead is quite consistent with the facts related in the numerous histories published of its action on man, and which, in the cases of the two men under consideration, suggest the extreme probability that they had been unwittingly exposed to the action of the metal, derived from one or more of those many sources which have been elaborately pointed out by Sir George Baker, (Med. Trans., vols. i. and ii.) and also by Dr Christison, in his valuable treatise on poisons; and from which this metal "may gain admittance into the human body unobserved and unsuspected." These patients may, for instance, have drunk it with water drawn through leaden pipes from cisterns constructed of lead, or raised from wells by leaden pumps, which both of them acknowledged they had done:—or it might have been introduced with their food, after separation from the glazed earthenware utensils employed in cookery;—or, lastly, they might, in the course of their daily work, have been exposed to the vapour of paint containing lead used by their fellow workmen.

From a careful perusal of the authors before

named, as well as from considerable personal experience, I presume to express a strong belief that the unobserved introduction of lead into the human body is continually taking place, to a much greater extent than is usually imagined, and that it has often caused an ambiguous assemblage of morbid symptoms: for although the influence of lead on the system is readily detected when the symptoms are severe and follow each other in the expected order of succession, yet when they are mild or do not follow each other in the regular and stated order of succession, if the mind of the physician is not awake to their cause, or the cause cannot be ascertained, then the symptoms appear ambiguous, and they may be misinterpreted without exposing the physician to the imputation of unpardonable ignorance, or of culpable oversight.

With reference to the irregularity observed in the order of events in colic from lead, Sir George Baker says, (Med. Trans., vol. iii.) "In this disease there are certain accidental varieties; the different manner in which it attacks different persons is one of these varieties:" and, in illustration of this statement, Dr. R. Warren (Med. Trans., vol. ii.) gives an account of thirty-two persons seized at the same period with lead colic. "One of these persons was attacked with an epileptic fit; three were feverish from the beginning; one was delirious, and four were salivated." These events are not usual in lead colic; "and," adds Dr. Warren, "as the complaint was not well understood when it first appeared," it

was "improperly treated," and every symptom was "increased."

Lead colic has also "many symptoms in common with a dysentery" and other abdominal diseases; and so long as their respective causes are unknown, the physician will experience much difficulty in making a precise diagnosis, and in discriminating between colic arising from lead, and that from either impacted fæces, acrid matter in the intestines, vegetable and other mineral poisons, or from worms. "The connexion," says Dr. Christison, p. 421, ed. 1829, "of colica pictonum with other causes besides the poison of lead, is upheld by so many facts, and is believed by so many authorities, that this disease cannot be assumed, even in its most characteristic form, as supplying undoubted evidence of the introduction of lead into the system."

But I contend that in abdominal diseases simulating lead colic, as well as other forms of disease about which any ambiguity exists, an inspection of the gums will decide the question, whether the symptoms were produced by lead. Thus, cases often occur in hospital practice in which the functions of the brain and cerebral nerves are paralysed by lead, and in which coma, vertigo, headache, amaurosis, and sometimes deafness, are the most evident effects; in other instances the patients complain of articular pains resembling those of chronic rheumatism, periostitis, and secondary syphilis. In many of these cases an inspection of the gums will assist in making a correct diagnosis; and with respect to the diffi-

culty of tracing chronic pains to their proper causes, Dr. Heberden, in his Commentaries, p. 131, says, "In plerisque his ægris nulla certa doloris causa investigari potuit." And in the chapter De Rheumatismo, p. 340, he adds, "Multi dolores, quibus nomina nondum propria imposita sunt, quanquam inter se distent, ex causis longe diversis orti, tamen ad rheumatismum pariter referuntur." I think articular pains, proceeding from the action of lead, have been treated sometimes as those of chronic rheumatism, at others as those of secondary syphilis, often empirically; and I could adduce evidence in proof of these opinions from my own practice; but in order to give them greater weight, I prefer adducing, on the authority of M. Andral, the case of a painter, (p. 236, tom. ii. Mal. de l'abdomen,) who, never having experienced lead colic, suffered during four or five months severe pains in the membranes of the head, which had been at first regarded as rheumatism, and unsuccessfully treated by bleeding and vapour baths; but there being afterwards reason for believing the pains were produced by lead, the patient was treated for ordinary lead colic, and recovered. To obviate, in similar cases, the opprobrium consequent on *mala praxis*, originating from an erroneous diagnosis, I repeat that a careful inspection of the gums will be sufficient in most cases of illness depending on the presence of lead, to reveal immediately the origin of the evil.

Assuming that the reasons adduced are sufficiently cogent to establish an opinion in favour of the pecu-

liar state of the gums above alluded to, being always discernible on patients under the full influence of lead, and that it precedes in the series of events the occurrence of colic and paralysis, the next problem to be solved is, whether the phenomenon can be made available as a means of averting the infliction of lead colic in the treatment of disease with saturnine preparations. To give an incontestable solution of this problem would require a greater number of data than I have hitherto been able to collect; nevertheless, on referring to my ward-books of the last few years, there appear to have been about twenty-seven patients treated with acetate of lead and opium; and out of that number, there were twenty at least in whom no colic and no other material inconvenience was induced by the remedy, except constipation; in two or three cases the colic symptoms were very severe, but in these latter the hæmorrhage was profuse, and the dose only proportionately large. But with ordinary precautions, colic does not occur severely during the medicinal use of lead; and I have frequently persevered in the use of the salt, for some time after the blue line had appeared, without producing it, or only slightly: the quantity which different patients took before the gums were affected, as well as the time, varied very much, and will be understood from an inspection of the following Table:—

Names.	Quantity of acetate of lead taken to produce the blue line, and time, how long.		Quantity taken after the blue line had appeared, and time, how long.		Total number of		Remarks.
	Grains.	Days.	Grains.	Days.	Grains.	Days.	
Bryan	15	4			15	4	Severe colic.
Bevan	96	12	112	14	208	26	Slight abdominal pains, relieved by an aperient.
Carter	66	11	100	18	166	29	Slight temporary pain.
Hamilton	70	14					No effect; incurable phthisis.
Ricketts	30	10	12	6	42	16	Slight temporary pain.
Godsell	160	21	135	12	295	33	No colic; died of profuse hæmorrhage.
Peasey	21	7	21	7	42	14	No colic.
Roach	24	4	18	3	42	7	No colic.
J. Bryan	56	7	56	7	112	14	No colic.

	Total.			Remarks.
	Grains.	Days.		
Dean	136	17	Blue line produced at an unknown period.	No colic.
Norton	116	13		No colic.
Casey	228	25		No colic.
Price	56	7		No colic.

As it is not the object of this paper to consider in detail the therapeutic uses of saturine preparations, I abstain from offering any comments on the above Table, further than to express my opinion that the difference observed in the quantity of the salt required to produce an effect on the systems of different patients, probably depended on idiosyncracy; for some of my patients were much more obnoxious to its influence than others, under conditions apparently similar.

The time required to produce the blue line varies

in general with the amount of the dose, but not always; and, *cæteris paribus*, large doses affect the gums sooner than small. Mr. Moyle of Chacewater produced the discolouration in twenty-four hours, by giving four doses of gr. v. each, every six hours; and I think it very probable, that in cases of poisoning, from "the irritant effects of large doses of the soluble salts of lead," similar to those described by Dr. Christison in his very valuable "Treatise on Poisons," the discolouration would be obvious on the gums in five hours after swallowing the salts; although the time required in several cases under my own care was much longer, in which large medicinal doses of the acetate were given frequently in twenty-four hours.

I have already stated the discolouration to have been more perceptible in several cases after death than it was during life; and I therefore suggest, that an examination of the gums will sometimes prove useful in medico-legal investigations, when death is supposed to have been occasioned by an irritating poison; in such cases, on the one hand, its presence will afford positive evidence of lead having been absorbed into the system; on the other hand, its absence will supply a negative testimony of the symptoms, during life, having been produced by some other poison.

With reference to the prophylactic utility of the blue line, I venture in conclusion to express a conviction that if the public in general, and workmen in particular, who are often exposed to the operation

of lead, were to attend habitually to the condition of their gums, the discolouration would be often perceived on them in the absence of any other unequivocal symptom, and its appearance would afford them a friendly warning of the probable approach of the more serious effects of lead on the nervous system.

A CASE

OF

DISEASE IN THE POSTERIOR COLUMNS

OF

THE SPINAL CORD.

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READ JANUARY 28TH, 1840.

The following case will probably be deemed worthy of publication, as a well marked example of disease strictly limited to the posterior columns of the spinal cord, yet producing phenomena at variance with the doctrine of the distinct influences of the anterior and posterior columns of the cord on the faculties of motion and sensation.

Joseph Cosden, aged 44, was admitted into St. Bartholomew's Hospital on account of the loss of the power of motion in his lower limbs, of which he gave the following history: that it had not been preceded by any external injury, and had commenced about three years previously; that at first, and for some time, the impairment of motion was slight, but had afterwards progressively increased to the present

period. In the investigation of the case on its admission, the patient was lifted into a chair; and when thus sitting, he did succeed, by a great effort, in raising his legs from the ground; but afterwards the inability of motion became complete through each lower limb in its entire extent. There was no discoverable impairment of sensation in any part of either limb: on scratching, pricking and pinching the skin, nowhere was any defect of feeling acknowledged by the patient. In the upper limbs there existed no defect either of motion or sensation. The general health was feeble. In the idea that the impairment of the lower limbs might in some degree depend on congestion in the vessels of the spinal cord, a few ounces of blood were taken, by cupping, from the loins; which reduced the pulse, and occasioned the feeling of extreme debility, but with no improvement in the limbs. Mercury was also administered to the extent of inducing moderate salivation, but with no benefit. The further symptoms were simply those of gradually increasing exhaustion of the vital powers, with inability to expel the urine or retain the fæces. Quinine, ammonia, wine, with the most nutritive diet, produced a slight and transient impression on the general health, but none on the condition of the lower limbs. At length he sank, about three months from the period of his admission into the hospital.

Throughout the progress of the case, the opinion had been freely expressed that it was one of disease in the spinal cord, and that we might expect this

disease to be limited to the anterior half or columns of the cord, or to the anterior roots of the spinal nerves. We found, on examining the body, the spinal cord to be the only seat of disease, but that this disease was strictly limited to its posterior half or columns. About an ounce of serous fluid was found in the theca of the cord; in other respects the membranes were healthy. The substance of the cord through its posterior half or columns, and in its entire length, from the pons to its lower end, had undergone the following changes of colour and consistence: it was of a dark brown colour, extremely soft and tenacious. The substance of the cord, through its anterior half and entire length, exhibited its natural whiteness and firm consistence; and on making a longitudinal section of the cord through its centre, and in the antero-posterior direction, the boundary line between the healthy and diseased nervous matter was seen to be most exact: it was a straight and uninterrupted line from the pons to the lower end of the cord. The roots of the spinal nerves were unaltered. The brain was healthy. The mucous membrane of the bladder exhibited the characters of recent inflammation. The kidneys and other viscera were sound.

The value of the foregoing case consists in the distinctness of its phenomena, and in the circumstance of these phenomena being acknowledged by many competent observers to have been such as they are here recorded. The patient was admitted into the medical wards under the care of my col-

league, Dr. Roupell, and afterwards transferred to the surgical wards under my charge; and the examination of the body was made in the pathological theatre in the presence of numerous students. The case is not wholly without a parallel,* but I know of none other in which the phenomena were so well marked. In its bearing on physiology, this case shows that with the full admission of the distinct attributes of the anterior and posterior roots of the spinal nerves as parts of the motive and sensitive apparatus, we cannot, in the present state of our knowledge, satisfactorily transfer the same view of the distinctness of function to the corresponding columns of nervous matter composing the spinal cord.

It would seem to be a safe conclusion that change of structure to the extent to which it occurred in the case now described, in a portion of the spinal cord, must be attended with a corresponding abolition of function alike in respect to the power of originating and of transmitting nervous influence; yet do we find well authenticated instances recorded of actual destruction by disease of a portion of the spinal cord

* Clinique Chirurgicale de l'hospital d'instruction de Strasbourg par P. Malle. 8vo. Paris, 1838.

" *Observation.*—Ramollissement de la partie postérieure de la moelle épinière avec perte de la motilité des extrémités supérieures, et persistence de la sensibilité." The spinal cord was found altered in structure between the fifth cervical and third dorsal vertebra. The alteration was most marked in the exterior of the cord, and gradually diminished towards its centre.

through its whole thickness, and with the persistence of voluntary motion and sensation in the parts below the seat of disease;* and in the same view, we may refer to the fact that in the case now related, with the change of structure in the cervical portion of the spinal cord, there was no impairment either of motion or sensation in the upper limbs. Such are the difficulties which, in the present state of our knowledge, attend the explanation of these pathological phenomena.

* Olivier, Traité de la moelle épinière et de ses Maladies, tome ii, Observation lxxxv.

ON THE

ARRANGEMENT OF THE INTERMEDIATE VESSELS

ON

SURFACES SECRETING PUS;

WITH

A NOTE REGARDING THE VASCULARITY OF ARTICULAR CARTILAGES.

By ROBERT LISTON, Esq.,

SURGEON OF THE NORTH LONDON HOSPITAL.

READ JANUARY 28TH, 1840.

The mode in which granulations are formed and receive their vascular supply, a process so necessary in the repair of suppurating cavities and breaches of surface occasioned by injury or other causes, is a subject certainly well deserving of the best attention of all who pursue the medical profession.

The success of a surgeon, more especially, will very much depend upon his careful discrimination of the various appearances of granulating surfaces, and upon the management which their various states may from time to time demand; for it is well known to those engaged in the practice of the profession, that there can be no surer index of the condition of a patient's system, than that derived from a careful examination of the aspect of a suppurating surface, and of the secretion which it furnishes.

That the granular deposit of lymph on surfaces exposed and unprotected by integument, is speedily supplied by blood-vessels, nerves, and absorbents, admits of no doubt, and is easily demonstrated by the examination and treatment of any healing ulcer.

It is proposed, very shortly, to describe the arrangement of the intermediate vessels on granulations, as they appear in the cysts of abscesses, and on open sores.

Mr. Hunter, the greatest authority, even to this day, on the subject, states that granulations do not appear on the internal surface of abscesses until they have been opened, and their cavities thus exposed to the influence of the atmosphere. In this view he has been supported by Dr. John Thomson, in his admirable, and now, it is to be regretted, very scarce work on Inflammation. Dr. Thomson appears to have investigated this part of his subject with the greatest possible care and attention.

It will appear, on careful examination, that the abscess is coated on the interior and free surface by a layer of lymph of greater or less thickness, as may be; generally, about one-tenth of an inch. This layer is first of all deposited in a fluid state, and consists of the liquor sanguinis, or fibrine in a state of solution, as separated from the blood. It is exuded in the form of minute transparent drops, which being spontaneously coagulable, gradually become milky and consistent. The granules appear first of all to become coagulated on the surface, and the interior of the drop, as it were, remains for a time

fluid and transparent. A sort of minutely granular or tuberculated surface externally, cellular internally, is thus formed.

This layer, with which the purulent deposit is in immediate contact, by and by becomes more consistent, and acquires a yellowish white colour. It lies upon a highly vascular membrane, to which it adheres more or less intimately, according to the duration of the process. The vessels in this tissue are curiously interlaced, anastomosing freely with each other, so as to form a very fine and delicate net-work.

There seems to be in this lymph, from the first, an impulse, as it were, towards organization; and after a very short time it becomes permeated by minute blood-vessels, which admit our fine injections. The diameter of the vessels was most frequently $\frac{1}{2000}$th of an inch. The extreme sizes being $\frac{1}{4000}$th and $\frac{1}{1333}$rd; and the following intermediate measurements were obtained, viz., $\frac{1}{3000}$th, $\frac{1}{2000}$th, $\frac{1}{1600}$th, and $\frac{1}{1500}$th of an inch.

These capillaries project into the new and adventitious membrane from that underneath it; often, in straight parallel lines. Their arrangement in the granules on the free surface is, however, distinctly looped and tortuous; and these loops communicate with each other, as shown in the very beautiful sketch which my friend, John Dalrymple, with much pains, has made for me under the microscope. The specimen is represented as magnified about four hundred diameters.—Plate I. fig. 1.

Which is the pyogenic membrane of authors, and so much talked about? Is it the very vascular base on which the lymph rests, or the adventitious false membrane?

The deposit of lymph in the greater number of situations and circumstances precedes the secretion of pus; and when this layer becomes organized, and the vessels assume the curiously convoluted and looped arrangement shown above, there can be no doubt but that the office of secretion is performed there.

The resemblance to the looping of vessels in healthy secreting surfaces cannot escape those who have devoted themselves to minute anatomical investigation. The surface of the skin, of the mucous linings, of the synovial sheaths, &c., present very much this vascular arrangement.

It is not unreasonable to suppose that morbid secretions may be furnished by capillary vessels similarly disposed.

It comes to be a question, how these looped vessels are produced. It is not easy to imagine that they are mere elongations of the original capillaries of the part, which have been dilated and relaxed. The deposit, as already remarked, seems to have an internal impulse towards organization.

Mr. Hunter has stated his suspicion that new parts have the power of making vessels and red blood, independently of the original circulation; and this view has been confirmed by the experiments of Kaltenbrunner and other observers on the cold-blooded

animals, the frog and mud-fish. Further investigations are required to elucidate this subject as concerns man and other warm-blooded animals.

In solutions of continuity reparation takes place, as has been well known since the time of John Hunter, by the deposit of plastic matter; and this layer, as that distinguished pathologist has shown, is speedily supplied by blood-vessels. On a careful examination of a portion of injected ulcer, more particularly in a profile view of it, it will be found that the secreting vessels are arranged in a precisely similar manner to those in granular deposits of lymph. This might have been expected, and so might the slight difference in appearance. These vessels on exposed surfaces are disposed in exactly the same fashion; but they are also enormously and irregularly dilated—varicose in fact, as here exhibited.—Plate I. fig. 2.

This is, without doubt, attributable to want of support from the natural elastic covering, and in a great measure also, to the affected part being often kept in a position unfavourable to the ready return of blood.

In neglected ulcers the vessels of the granulations are, in fact, often distended to bursting; and great quantities of blood frequently escape from the surface of such ulcers in consequence. The dark colour of the sore, the bloody and gleety discharge, very soon show to the surgeon of experience in hospital practice whether or not the patient obeys the injunction to keep the limb elevated. Soon also, does he

discover whether or not, any trick is attempted by ligature or otherwise, to interrupt the progress of cure.

The purulent secretion cannot be poured out from open mouths, as they are not seen to exist, but is probably transuded through the coats of the looped, tortuous and dilated capillaries, and is possibly changed in appearance afterwards, in the same manner in which lymph is previously separated from the blood, and escapes through the coats of the inflamed vessels.

I have been encouraged to offer these remarks to the Society from finding that many vague and incorrect notions respecting the nature of the membrane secreting purulent matter are generally entertained; and from ascertaining also, that no correct delineations of the vessels of lymph or granulations have been published. That of Pauli gives but a very incorrect notion of the proper appearance.

It represents a flat tuberculated surface with a sort of net-work spread upon it. Those which I have ventured to present are correctly delineated from profile sections of the cyst of an abscess and ulcer.

I might have given other views from my own injections, and also, through the kindness of my colleague, Dr. Sharpey, of a very successful injection by Professor Pockels of Brunswick. This specimen has been described by Dr. Allen Thomson in his excellent paper on the formation of new blood-vessels.

This is also a flat piece of ulcerated surface, but it shows the peculiar arrangement very much better than the plate given by Pauli.

As regards cicatrix, it may be remarked, that the

vessels speedily contract. They are arranged in a reticular fashion, but, after a time, the net-work is not nearly so full as in the surrounding skin.

Occasionally, an approach to the papillary arrangement seems to be attempted, as seen in good sections after successful injections.

I may, I trust, be pardoned for offering a few practical deductions from the preceding observations; and first of all, the mischievous effects of squeezing together the sides of suppurating cavities may be noticed.

By this proceeding, adopted through a blind and thoughtless observance of the bad practice of others, the lymphatic coating is separated from its vascular base; the circulation of the part is unnecessarily excited; bloody and often putrid secretion is poured out; and the general health in consequence disturbed. If a sufficient opening is made in a dependent position, the accumulated secretion is rapidly enough discharged; and the walls of the cavity come together and coalesce through the natural elasticity and action of the parts.

As regards ulcers, the paramount advantage of an elevated position of the affected part must be sufficiently obvious. The rapid disappearance of congestive swelling, and of inflammation by an observance of this practice alone, in many cases, must make apparent the good effects of favouring the return of blood.

The larger veins, previously varicose and over distended, become collapsed, and almost disappear.

The same effect upon the varicose capillaries in the solution of continuity necessarily follows; the colour of the sore is speedily altered for the better, the painful feelings abate, and the nature of the discharge is ameliorated. Until this is the case, and as long as over-action, to any degree exists, soothing and relaxing applications are advantageous; exudation of lymph and plentiful secretion of pus are thus encouraged.

These are followed by mild astringents and stimulants, by which the dilated and weakened condition of the coats of the vessels may be supposed to be amended.

The discharge is thus moderated, and the granulations prevented in a manner, from becoming exuberant. The beneficial effects of uniform support can also be well understood.

The admirable papers on Diseases of the Joints, by our distinguished President, and also by Messrs. Mayo and Key, read before this Society, and published in their Transactions, leave, it may well be supposed, very little further to be said on the subject.

Having, however, succeeded in injecting minutely, some limbs removed on account of articular disease, I venture to present a few observations, the result of an attentive examination of parts of them under the microscope.

A question, it is well known, has been agitated, as to whether articular cartilage is extravascular or

not; Cruveilhier, Velpeau, and Key, espousing the former doctrine, and maintaining that it is a mere epidermic crust, endowed with no organic life, and hence unsusceptible of disease.

Sir B. Brodie and Mr. Mayo support the opposite opinion. Sir B. Brodie supports his views by argument principally, and by observation of vessels containing red blood, extending from a diseased bone into cartilage covering it. Mr. Mayo notices the same circumstance, and refers to preparations, now in the museum of King's College, London, and of which he has given representations in the nineteenth volume of the Society's Transactions. These specimens I have examined with great care, but so far as I can observe, they exhibit nothing at all satisfactory on the subject.

There is some injection on the edge of the cartilage of the condyle of the femur, in one of the preparations, and a shred of lymph is adherent, apparently at one point, to the surface of the cartilage. Vessels filled with injection may or may not exist in the cartilage, but this can only be ascertained by having thin slices made, and putting these under a good glass.

I have been enabled to demonstrate the existence of vessels, most undeniably, in the articular cartilage of several diseased joints, and present a sketch of one portion, Plate I. fig. 3. It will be observed that the vessels run straight, in parallel lines, from the injected membrane of the bone. Many of these are joined at their further extremity in the cartilage,

thus forming long loops. The possibility of cartilage being acted upon, nourished, absorbed, and repaired, by its own vessels, must thus be admitted. In fact, in many of the specimens in my possession, lymph is deposited on the surface of ulcerated cartilage, and injected vessels can be traced, passing into this lymph.

Under circumstances favourable for it, solutions of continuity in cartilage appear to be repaired, without, however, much reproduction of the tissue.

It would appear that ulcerative absorption of cartilage occurs in three forms:—

First. In consequence of disease of synovial membrane, which becomes much swollen, and to which processes of adventitious tissue are superadded, the cartilage is removed where it is encroached and pressed upon. The prolongations of the membrane, in a highly injected state, as well described by Mr. Key, fit most accurately to every crevice of the breach of surface in the cartilage. At first there is no union of the surfaces, the membrane being merely accurately adapted and closely applied to the ulcerated surface. Frequently, however, as the disease advances, adhesions form betwixt the vessels of the synovial membrane, and those proceeding from the medullary web. An adhesion of considerable length is thus often formed betwixt the synovial surface, and the articulating end of the bone.

Second. Absorption of cartilage seems often to arise from swelling and intense vascularity of the

tissue connecting it to the bone. This cellular tissue is scarcely demonstrable in the healthy condition of parts, any more than is the vascularity of the articular cartilage; but it becomes most remarkably developed in a state of disease. The cartilage is in consequence loosened and thinned; at first, apparently, by interstitial absorption. Then it becomes perforated, and an ulcer, of greater or less extent, with thin undermined edges, is presented. In consequence of disease of the interposed tissue, the cartilage is sometimes thinned, and ultimately detached in flakes; forming, in fact, sequestra of the tissue.

Third. Lastly, cartilage still firmly adherent to the subjacent bone, is permeated by vessels communicating with those of the bone, and ulceration proceeds from the free surface. The cartilage, very often previously swollen and softened, is gradually and irregularly thinned: the bone is exposed, and is finally acted upon also, by ulcerative absorption. The ulcerated surface is generally coated by a layer of organized lymph. More than one form of the ulcerative process may sometimes be observed in the same articulation.

REMARKS

ON THE

DIAGNOSIS

OF

FOREIGN BODIES IN THE LARYNX.

By CÆSAR H. HAWKINS, Esq.,

SURGEON TO ST. GEORGE'S HOSPITAL.

READ FEBRUARY 11TH, 1840.

So many cases have been recorded in which foreign bodies have entered the windpipe, and the propriety of extracting them by operation is so well established, that any remarks upon the subject may perhaps appear superfluous. Yet so many of these recorded cases are of a chronic kind, in which an operation was not performed till many weeks or months after the occurrence of the accident, or in which a fatal result ensued, because no operation was practised, as to make it evident that the diagnosis is either attended with much difficulty, or that surgeons have been more reluctant than they should have been, to resort to the only means that can be successful; except in some rare cases, which ought to be considered only as exceptions to the general rule. It is said indeed by Mr. Porter, that

many children are probably carried off by this accident, who have been supposed to die of croup, and that consequently the difficulty of recognizing the nature of the case makes the occurrence of the accident appear much less frequent than it really is; and the remark is probably not without foundation, when so experienced a surgeon as Dessault is found to enumerate among the general signs of the accident, "a difficulty more or less considerable in deglutition, which is sometimes very painful, and a sensible alteration in the voice, which is commonly hoarse, and is sometimes completely prevented;" the latter sign being in fact by no means frequent, according to the cases on record, and the former being actually rather a sign that the foreign body is *not* in the windpipe, but more probably behind it, in the œsophagus.

Among other points desirable to be ascertained, when the nature of the accident is suspected, is the probable situation of the intruding body, as indicated by the symptoms which it occasions in different parts of the air passages; I am led therefore to think the following case may not be devoid of interest to the Society:—

On November 18th, I was asked to see Miss S., twelve years of age, who had been suddenly seized, while taking some soup about eight hours before, with violent vomiting, and suffocating cough, which lasted for a short time, and then left her with a noise in breathing, which was somewhat difficult,

and with a sense of pain beneath the cricoid cartilage. She believed she had felt a piece of bone in her mouth at the time, and that she had swallowed it. About two hours after the accident an emetic had been administered by Mr. Davis, the assistant of a medical man in the neighbourhood, which had brought up some solid meat, and seemed to have a little relieved her.

At the time I saw her she was breathing with a croupy noise at each inspiration, but without much labour, and she complained of some pain and tenderness in the larynx, referred more particularly to the cricoid cartilage. She could swallow without any difficulty, and on examination with a pair of curved forceps, it was evident that there was nothing in the œsophagus at the seat of the pain. The finger, passed behind the epiglottis, felt nothing like a foreign body in that situation; her voice was natural, and there was no cough, nor had there been any since the accident, to which attention would otherwise have been drawn. The tongue was a little dirty, she was flushed, and the eyes suffused, and the pulse quickened, and there was some anxiety of expression. She had been in good health before the accident, except that she had a slight cold the day before, with a sense of tightness across the epigastrium. The lungs appeared healthy, and there was no other apparent cause for the croupy noise and difficulty of respiration, except a good deal of fullness and redness of the tonsils and palate and fauces, which might extend to the larynx, but

which might also have been the consequence of the vomiting occasioned by the accident and by the emetic.

There could, altogether, be little doubt that her supposition was correct, and that a piece of bone had passed the wrong way; but as there were no immediately urgent symptoms, as there had been no threatening of suffocating cough since the accident, now eight hours ago, and the difficulty of breathing was not great, and was less than it had been, and the foreign body, if it were present, must therefore be nearly fixed, and could not be of large size, and as there was much fullness of the fauces, which might occasion some narrowing of the glottis, and as the croupy noise was in inspiration only, as in common croup, it was agreed to leave her till the morning, administering some calomel and antimony, and applying a sinapism to the throat, and then to operate if no change took place.

On the succeeding morning the inflammatory redness and fullness of the fauces had nearly gone, the mustard poultice had relieved her from all feeling of distress in breathing, and she was no longer feverish and flushed; but the noise in respiration was as constant as before, and was equally audible in expiration and in inspiration, and a little pain and tenderness remained below the cricoid cartilage. It was perfectly clear, therefore, that the obstruction was purely of a mechanical nature, and was too considerable to justify an expectation that it would probably be disengaged spontaneously.

Mr. Babington was kind enough to see the patient with me, and concurred in this opinion, and also in thinking that the space between the thyroid and cricoid cartilages was so small as to make an incision into the trachea preferable to an operation in the former situation. I therefore made the usual opening into the trachea, just below the thyroid gland, which was unattended with any hæmorrhage, and removed a small piece of two rings of the trachea, in the centre of the incision, which was made through three others also, and endeavoured to get the piece of bone thrown out by making the patient cough repeatedly, but without avail; feeling the foreign substance with the probe just above the opening, I then introduced a pair of forceps and extracted it, not without some little violence, from the manner in which it was fixed. It was a portion, as it seemed, of the spine, shewing the curved surface of the canal of a vertebra in a neck of mutton, nearly half an inch long, and a third of an inch wide, the outer surface being very rough and irregular, so as to account for its fixed position below the glottis.

The breathing immediately became free from sound, and she had neither cough nor other unfavourable symptoms after the operation. The wound was at first lightly approximated, but the air scarcely escaped after the patient returned to bed, and the voice was perfectly restored in about three hours, by the union of the surfaces; the edges were therefore brought together more completely the next day,

and the healing process went on favourably, without the occurrence of any circumstance worth notice.

Firstly. In by far the greater number of instances, a foreign body which has entered the windpipe continues to be moveable within the trachea. The chief circumstances determining the diagnosis of this accident are thus enumerated in the useful work of Mr. Ryland, the most recent upon the diseases of the larynx.

From laryngitis, or croup, he says, "this accident may be distinguished by the absence of fever at first; by the very sudden manner in which the symptoms came on; by the *intermission* in the difficulty of breathing, which sometimes continues for an hour or two; by the *noise* occasionally heard when the foreign body is impelled against the vocal cords; by the *excessive violence* of the *cough* after this occurrence, and most *particularly* by the chief difficulty of breathing being during the time that the *expiratory* process is going on; whilst in laryngitis the chief difficulty is in the act of inspiration."

No doubt this account is generally correct, when the intruding substance is *within the trachea*, even when it has been surrounded by tenacious mucus, causing it, at the time of operation, to be adherent to the membrane of the tube, so as not to be immediately expelled, as in a case of Sir Charles Bell's at the Middlesex Hospital;* or when it has adhered by some roughness, as in a case of a piece of the

* Medical Gazette, vol. v, p. 74.

jaw of a mackarel, extracted by Pelletan.* Yet it will be observed, that in the preceding case scarcely one of these symptoms corresponded with what really took place; the attack was indeed sudden, so as by itself to render the case scarcely doubtful; but there *was* a good deal of feverish excitement when I first saw the patient; there was *no intermission* whatever in the difficulty of breathing, and for the same reason *no noise* could be heard by the striking of the substance against the vocal cords; there was absolutely *no cough* whatever after the first few seconds; and instead of the noise in breathing being chiefly in *inspiration*, it was heard, on the day of the accident, only in *expiration*, and on the following day it was equally audible in *both portions* of the respiratory process.

Secondly. When a foreign body is moveable within the trachea, it has been frequently found to pass into the right bronchus; and some interesting cases of this kind have been published by Mr. Key, Dr. Houston, Mr. Liston, and others, who have shown the absence of the symptoms before enumerated, if it remains almost entirely in this situation, together with the new stethoscopic signs of its presence in the bronchus, viz., the freedom of the larynx from disease, and the occasional or permanent cessation of respiration in the lung of the affected side.

Thirdly. If the foreign body is actually fixed within the vocal cords, instant and sudden death

* Clinique Chirurgicale, vol. i, p. 6.

has usually been the immediate result; whether it has been impacted in this situation at once, or has first moved freely within the trachea, and has been subsequently fixed in the glottis during a fit of coughing, as in an interesting case related by Mr. Porter.*

Fourthly. If it is fixed within the larynx in some other situation, as in the ventricles, without causing immediately fatal effects, a foreign body is yet generally said to occasion much distress and danger. "It will produce," it is said by Dr. Stokes, "more or less *violent* and *incessant attacks* of *cough* and *dyspnœa*, in which the lungs are found, on auscultation, to be sound, and the larynx to be the seat of the constriction; the permanency of which, together with the history, will point out the nature of the case." "It may happen," says Mr. Porter, "that if the body be round and polished and small, it shall occasion no symptom of distress, except *the cough*, and the *difficulty* of *breathing*, and the patient may exist for a long time without the occurrence of those morbid actions which render the accident certainly fatal." The cough and obstruction to respiration being expected to be present, it is seen, even in such comparatively mild cases. These urgent symptoms were present, threatening suffocation, in a case in which Pelletan operated six weeks after the accident, and was obliged to slit up the cricoid cartilage to extract a button from this place;

* Porter on the Larynx.

and in a case of Dessault's, which was fatal two years after a cherry-stone had been lodged in one of the ventricles, the same occasional fits of suffocation were produced by it; and Dessault advises the division of the thyroid cartilage when the foreign body is fixed in this situation.

But, fifthly, that a foreign body should be fixed in the larynx *below* the glottis, and that the symptoms should be much modified by this position, does not appear to have been noticed by writers upon this subject; except that the cough, in cases of foreign bodies within the air-tube, arising from the direct irritation of the glottis, the absence of this symptom, it has been remarked, may be considered as a presumptive proof that the foreign body is fixed somewhere in the tube. Even this remark, however, requires some correction, since it must be recollected that the fatal effects upon the *lungs* may occasion cough, although without so much distress, as in the cough produced by direct irritation of the glottis. The part of the larynx immediately below the glottis is not enumerated by any writer, as one of the situations in which a fixed foreign body is to be looked for, although some distinctions have been attempted to be drawn of the symptoms likely to be occasioned by the different situations I have before alluded to, viz., the glottis itself, or one of the ventricles of the larynx, or the tracheal tube, or one of the bronchi. I have lately looked over the accounts of between seventy and eighty cases related in various works, of the entrance of foreign bodies

into the air-passages, and have met with only two that correspond with the preceding case in the nature of the symptoms. One of these is related by M. Lescure, in the fifth volume of the Memoirs of the Academy of Surgery, and in it part of an apricot kernel appears to have been fixed in exactly the same position, directly under the cricoid cartilage. It differs indeed from mine in not having an operation performed, and being therefore fatal in sixty hours, from emphysema and congestion of the lungs, but it corresponds with mine in the *entire absence* of cough, the *constant whistling* sound, the unaffected state of the *voice*, and in the *fixed pain* at the part, and in the child being able to laugh, and speak, and eat, *as usual*, on the following day.

A second case is related by Mr. Bullock, in the eighteenth volume of the Medical Gazette, p. 951, in which a quartz pebble was lodged in the same position as in my patient, " partly within the cricoid cartilage, partly in the trachea," and in that also the symptoms were so mild as to mislead the attendant, notwithstanding the continued assertion of the child that the stone was lodged in the part, although they were much more severe than in mine in the first instance, there being for four days " a sense of soreness in the throat, with nausea, which was accompanied by occasional *slight paroxysms of cough*, with a copious *mucous* expectoration, and hoarseness of the voice."

It will be observed, that in this latter case there was some cough, which was not at all produced in

either of the two others; there was on the fifth day acute inflammation of the mucous membrane, after which there was *entire absence of cough*, and no *return of uneasiness in the throat*, till her death, eight weeks after the accident, from acute pneumonia of both lungs. The pebble was retained in its situation by a thick layer of organized lymph, and the calibre of the tube was so nearly obstructed as to render it difficult to pass an ordinary-sized probe downwards.

It appears then that in three cases in which a foreign body was fixed in the situation of the cricoid cartilage below the glottis, the severe paroxysms of coughing, which are invariably looked for as evidence of the presence of a foreign body, (but which really belong essentially to its presence in other parts of the tube,) were entirely absent in two, and were mild in the third, so as to lead the surgeon to believe they could not arise from the entrance of the pebble, as the child asserted, and were afterwards entirely absent in the last month of her life;—that even the voice was unaffected in two of the cases, although hoarse in the third case;—but that in all three cases there was soreness and uneasiness in the part where the foreign body was fixed, a *noise* in inspiration or expiration, or in both, from the mechanical effect of the intruding substance, (mistaken indeed for croup in one of them,) and in all, the *patient asserted* that something had been *swallowed*.

Where such circumstances as these are present to guide the surgeon, I conceive he is imperatively

called upon to operate without much delay, since out of the only three cases, with which I am acquainted, in which the foreign body has been thus lodged and fixed near the glottis, two were fatal; one within sixty hours, by the immediate effects upon the lungs, though without any other symptom than in my own case; the other at a later period, by the slower influence of inflammation; while in my patient a more fortunate result was met with, in consequence, it cannot be doubted, of the removal of the foreign body, at an early period, by an operation, which is seldom very difficult, except in very young children, and perhaps is never attended with any important risk.

HISTORY OF A CASE

IN WHICH THE

OPERATION OF TRACHEOTOMY

WAS PERFORMED;

WITH

OBSERVATIONS.

By BENJAMIN TRAVERS, Jun., Esq.,

LECTURER ON ANATOMY AT ST. THOMAS'S HOSPITAL.

Communicated by his Father.

READ FEBRUARY 11TH, 1840.

Harriet Smyth, a robust girl aged six years, the daughter of a farmer residing near Eye in Suffolk, whilst sitting upon some straw in the yard, was suddenly thrown backwards by a pig concealed beneath the heap. She was eating cherries at the moment, and was immediately seized with a violent fit of choking, and every symptom of impending suffocation. This condition lasted an hour, and then she fell asleep. The accident occurred about four o'clock in the afternoon of Friday, July 19th. She was seen an hour afterwards by Mr. Vincent, surgeon, of Rickinghall. Being awakened by slight cough, some emetic and purgative medicine was given, but no

stone was detected in the matters rejected from the stomach and bowels.

The child slept well during the ensuing night, and in the absence of cough, Mr. Vincent concluded that the stone or offending body must have been swallowed.

20th.—Some spasmodic pain in the chest, increased towards midnight.

21st.—At seven in the morning, the breathing was very difficult, and other symptoms of acute inflammation being present, twelve ounces of blood were drawn from the arm, and a dose of calomel and jalap administered. After the operation of the medicine, small doses of calomel and opium were given at intervals.

22nd, eight A.M.—Patient relieved: towards four P.M. she had a violent convulsive seizure with cough, small quick pulse, a livid surface, suffused eye, and every sign of threatened suffocation. It was stated in evidence of the violence of the spasm, that the stools and urine "flew" from the child during these attacks. I witnessed the peculiar manner in which the patient grasped and pulled her throat, crying in a half whisper, "Take it out!" "Take it away!" The spasm subsided after two hours' continuance, and at eight P.M. she was so tranquil as again to impress Mr. Vincent with the belief that no stone could have passed into the trachea.

23rd.—At noon a similar seizure occurred. There was violent jactitation, and abundant flow of frothy mucus from the mouth. When this fit subsided, a

probang was introduced, and subsequently the child swallowed with greater facility. Cough frequent and sonorous.

The patient was carried to Bury about this time, and seen by Dr. Probert, an eminent physician, and Mr. Smith, surgeon, of the same town. Dr. P. strongly suspected the existence of a foreign body, but felt anxious to witness the spasm before he gave his sanction to an operation.

25th.—Dr. P. and Mr. S. were called to see the spasm at six A.M.: it subsided, however, before their arrival. The child then resorted to its amusements, there being no disorder except occasional cough.

On the 26th the patient was carried home, and remained well until the 1st of August, when the spasmodic attack returned with great violence, lasting two hours. The seizure now recurred daily, varying as to degree and duration.

I first visited the child in company with Mr. Vincent on the evening of Wednesday the 7th instant. She had just recovered from a severe fit of cough, and was sleeping uneasily. When roused, her breathing was laboured and stridulous, pulse small and hurried, countenance anxious and suffused: there were frequent paroxysms of croupy cough, attended by great restlessness, and that peculiar grasping of the throat before noticed. The temperature was sustained. The attacks were now more frequent, and the consequent exhaustion more marked.

No time was lost in preparing for the operation.

I felt satisfied that the foreign body was still in the air-tube; uncertain as to its immediate escape, I hoped at all events to relieve the respiration, nor was I disappointed in this result.

About midnight, the child being placed supine upon a firm table, and the head and shoulders slightly raised, I made a free incision in the median line. In dividing the subjacent fascia, a large vein was wounded, and tied. The incessant motion of the tube, and its great relative depth in so young a child, retarded our progress; but I succeeded in dividing vertically three rings of the trachea, together with the connecting membrane about midway between the isthmus of the thyroid gland and top of the sternum. The patient was now placed in the sitting posture, and by inclining the head forwards an oval aperture was produced, of sufficient extent to have permitted the escape of the stone, had it been free to move in the canal.

The effect of this operation was immediate and decisive upon the breathing, which became tranquil; the cough also ceased. After a brief repose, I determined, before quitting the house, to ascertain whether the larynx was obstructed. For this purpose I introduced a piece of hollow bougie through the wound into the trachea: this however proved unmanageable, from its too great flexibility; a silver catheter was substituted for the bougie, and pushed upwards fairly through the glottis, which I ascertained by passing my fore finger over the base of

the tongue, so as to touch the apex of the instrument in that situation.

The child was now placed in bed, and obtained some refreshing sleep, breathing wholly by the new opening, through which a frothy fluid passed in quantity.

August 12th.—The cough had returned, but was not so severe as formerly.

13th.—Calomel, which had been given in grain doses every six hours since the operation, was now discontinued, the gums being sore.

Towards the close of the following month, the wound which had been tented was healed. In the beginning of October the child coughed incessantly, and had night sweats, with loss of strength and appetite.

Oct. 10th.—She was again seen by Dr. Probert, who feared the lungs were diseased, and ordered sarsaparilla and a nutritious diet. Mr. Vincent still insisted that the presence of the stone was the source of the irritation. He states that he founded this opinion chiefly upon the choking character of the cough.

Oct. 23rd.—At 6 P.M. his suspicion was verified by the ejection of the stone, together with a tablespoonful of pus, during a violent paroxysm of cough.

The child had, in fact, expectorated pus in small quantities for many days before this happy accident.

From this time the cough never returned, and the general health was soon re-established.

The Transactions of the Society contain several papers, wherein the efficacy of bronchotomy has been much insisted upon. Experience has shown that the operation is not in itself hazardous, and that success turns mainly upon its prompt performance. This is true no less of accidental obstructions, than of such as occur during the progress of inflammation.

There is, however, a marked difference between the disorder arising from the presence of a foreign body in the air-tube and that which results from inflammation simply. In the first case the symptoms are paroxysmal or intermittent, in the second they have no remission, and, it may be added, are therefore more rapidly destructive. Hence there is opportunity for doubt and deliberation in the one case, whilst in the other the surgeon has no alternative.

It appears that both in the early and later stages of the above history a very competent judge remained sceptical, if not incredulous, as to the presence of the foreign body. There were not wanting symptoms proper to other forms of disease, and at no time did there exist any clue to the spot where the substance actually lay. It was indeed stated more than once in the present case, and it has been affirmed in others, that the body might be distinctly heard moving with the air up and down the tube, making a flipping or rattling noise (likened on one occasion to the sound of a stone shaken violently in an earthen jar or mug). Without seeking to deny

the fact, I will merely observe that such sounds are often delusive,* and in the foregoing case all the evidence weighs against the belief that the substance was free to move in the trachea.

In section of the air-tube, the escape of the foreign body appears to me to be a calculation secondary in importance to that of affording a prompt and effectual relief to the process of respiration. It is evident that the powers of life depend on this issue, and that these may be secured for a time by an artificial opening, although the source of irritation be still present.

In this point of view the operation was most beneficial; a vast quantity of frothy fluid was got rid of, the pulmonic and cerebral circulation was at once relieved, and the patient slept, breathing wholly by the new aperture. Time was thus afforded to make a second appeal to the powers of nature, and the part was relieved finally by a different process.

There are some curious facts on record in reference to the length of time for which foreign substances may reside in the air-tube; the manner of their dislodgment also varies.

In the 5th volume of the Memoirs of the French Academy are two remarkable cases cited by M. de la

* In the case of a boy, narrated by Dr. Farre in the 3rd volume of the "Transactions," who died of *true croup* forty-eight hours after the attack, the mother states "that a noise attended every respiration, which she expressed by the monosyllables 'Flip, Flap.' It seemed to her that something was lifted up every time he breathed."

Martinière. In the first a tradesman accidentally swallowed a louis d'or on the morning of the 5th October 1765. The man survived until the 3rd of February 1771. The right lung was destroyed by suppuration, the left remaining sound. The coin was found placed perpendicularly in the right bronchus, close to the bifurcation of the trachea. The expectoration in this instance is stated to have been insupportably fetid.

M. Louis saw this man in 1769, and proposed tracheotomy, which was overruled. The coin remained unaltered in figure and colour, and on being placed in the rima glottidis after death, passed through it with ease.

In a second case a girl in her ninth year swallowed the rump bone of a pigeon, which unhappily fell into the trachea. She was the subject of hæmoptysis and a variety of pulmonary symptoms, but retained her embonpoint up to the age of 24 years, when she began to decline rapidly. In her 26th year she rejected the substance during a violent fit of coughing. She survived this occurrence eighteen months, dying eventually exhausted by profuse purulent expectoration.

In the first of these cases the mechanical impediment was so complete as to defy all the efforts of the natural surgeon, instituted in either instance at the cost of the patient's existence. The release of the foreign substance in the second case was rather incidental to the progress of disease than due to any circumscribed local action. At this period of our

science it is impossible not to feel that on both occasions the patient might have been rescued by the timely performance of an operation.

Where the body is loosened and rejected spontaneously, one would conclude *à priori*, that this could only be accomplished by means of an abscess. Such however is not always the fact, as is proved by the following case, for which I am indebted to Dr. Paris.

"I was suddenly summoned to visit Miss C. P., a young lady about twelve years of age, under the following circumstances: I was informed, that having put a small cowrie shell in her mouth she had been seized with a violent choking fit, in consequence, as was supposed, of its having gone the wrong way in the act of swallowing it. The spasmodic paroxysm was described as most alarming, and continued for several seconds, which induced her father to thrust his finger with considerable force down her throat, which afforded immediate relief, and therefore convinced him that he had thrust the foreign body into the œsophagus, and that it had passed into the stomach. I saw her about half an hour after the occurrence: she was then breathing naturally, and declared she did not feel the least inconvenience from what had happened. In the course of four or five days a slight cough came on, but it was not characterised by any symptom which could lead to the suspicion of its having been provoked by the presence of any foreign body in the air-passages, and this opinion was confirmed by its speedily yielding to ordinary treatment.

"About ten days after this I was again sent for, in consequence of the appearance of an eruption over the body, very much resembling that of scarlatina accompanied with slight fever; but there did not remain the least vestige of cough or bronchial irritation, and the rash was speedily cured by some saline purgatives. As far as I remember, an interval of a fortnight occurred before I again visited her, when I found a return of the cough, much more violent than usual and accompanied with slight hæmoptysis. This, however, again subsided, and she remained for many months in perfect health; her breathing was never disturbed, she indulged in her usual active habits and daily exercise, and declared that she was perfectly well. I should state that the pulse was never accelerated, and I was induced to refer the cough to some local irritation, occasioned by the violence with which her father had thrust down the shell. It was about twelve months after the accident that the following event occurred, which clears up the mystery in which this curious case had been involved.

"She had danced at a ball during the whole evening, and at its conclusion, in the act of moving briskly, she was suddenly attacked by a violent spasmodic cough which threatened suffocation, when by a sudden and convulsive expiration, a substance was ejected from her mouth with such force as to be carried to a considerable distance. This proved to be the remnant of the shell, the animal principle of

which had disappeared, and its earthy matter alone remained."

The following case is described at length by Mr. Bullock, in the eighteenth volume of the Medical Gazette. I refer to it in this place as illustrative of another series of symptoms, having a more rapidly fatal termination in the very young subject. I think it not improbable that my patient would have been destroyed in the same manner, but for the timely succour of the operation.

May 21st, 1836.—A little girl swallowed by accident a small pebble, whereupon she was seized with violent cough, became black in the face, and was nearly suffocated. She rallied, and some days afterwards complained of soreness and nausea, but swallowed without pain or difficulty. Emetics produced no effect.

May 25th.—She was very carefully examined, yet there did not appear any evidence of the presence of the stone, either in the œsophagus or trachea.

May 27th.—There has been cough occurring in paroxysms with hoarseness and mucous expectoration; also a sharp pulse and hot skin. These symptoms were speedily relieved by calomel and blisters.

June 20th.—She is reported to be quite well.

July 6th.—She was attacked with pneumonia, for which she was very actively treated without success. The disease proved fatal on the twelfth day.

Now it is stated that from June the 20th until July the 18th, the date of her decease, there was no return of the convulsive cough, nor any uneasiness about the throat.

On laying open the windpipe, a quartz pebble was found lying partly within the cricoid cartilage and partly in the trachea: it was of the size of a large horse bean, and retained in its situation by organized lymph. The mucous membrane beneath the lymph was ulcerated, and the calibre of the tube so nearly obstructed, as to render the passage of a common probe difficult. The mucous membrane throughout was thickened and congested. The lungs, especially the right, presented the conditions of engorgement, hepatization, and purulent infiltration. The tubes were loaded with muco-purulent fluid. A pint of turbid serum was found in the right cavity of the pleura. The bronchial glands were enlarged and suppurating.

In conclusion, it would appear that nature is capable of procuring the spontaneous liberation of a foreign body in some cases, whilst in others an irritation only is induced which, if prolonged, is fatal alike to the lungs and life of the patient. In the latter class of cases the difficulty of ascertaining the exact locality of the foreign body, the age of the patient at the time of the accident, and the particular state of the habit, are all questions which bear upon an inquiry having reference to the performance of an operation. In childhood, for exam-

ple, the progress of incidental disorder is more rapid than during the adult period. In Mr. Bullock's case, every important local symptom had ceased to exist for a whole month preceding the day of the child's death: the breathing was not materially affected during that interval, notwithstanding the narrowness of the air-passage. Again, reference was made to the cricoid cartilage in M. Louis's case, but the coin was found after death lodged in the right bronchus. Sometimes the presence of a foreign body may be only matter of suspicion; or, on the other hand, there may be no doubt as to its existence, although its exact position may be very obscure. In either case, a due estimate of the powers of life and special attention to the degree of dyspnœa are essential to the formation of a sound opinion.

From the foregoing narrative may be gathered the expediency of performing tracheotomy in doubtful cases. The risk incurred by early operation is trivial as compared on the one hand with the speedy relief so obtained, and on the other with the fatal consequences of neglecting it altogether.

I have only further to bear testimony to the inexpediency of putting any tube into the trachea after operation, whether elastic or metallic; a sufficient opening may and ought always to be provided by the knife. Where a foreign body is present, such procedure induces excessive spasm, and can only operate in aggravation of the mischief.

MEMOIRS

ON SOME

PRINCIPLES OF THE PATHOLOGY

OF THE

NERVOUS SYSTEM.

By MARSHALL HALL, M.D., F.R.S. L. & E. &c.

READ FEBRUARY 25TH, 1840.

MEMOIR II.

On the Morbid Reflex and Retrograde Actions of the Spinal Marrow.

I PROCEED to fulfil my promise of the last session* to lay before the Society the result of my observations on the singular phenomena of the reflex and retrograde actions of the spinal marrow observed in various diseases. I shall first treat of

I. THE REFLEX ACTIONS.

I need scarcely recall to the attention of the members of this Society, the series of *experiments* related by Redi, Whytt, Legallois, Blane, Mr. Mayo, &c., or my own, relative to this interesting subject. But I must briefly advert to the principle of action,

* See the Transactions of this Society, vol. xxii, p. 217.

with its newly discovered laws, upon which these experimental phenomena depend, and to the extension of that principle to physiology—to the physiology of ingestion and egestion in the animal economy, which are the results of my own investigations.

In treating of certain muscular motions, produced by the irritation of muscular nerves, Haller distinctly speaks of two principles of those motions—the motive power residing in the nerve, which he designates the *vis nervosa*, and the moving power residing in the muscle, which he designates irritability or the *vis insita*.

Of the *vis nervosa*, Haller,* Bichat,† and Professor Müller,‡ all most distinctly state, that it acts in *one* direction only, viz., that *from* trunk *to* branch, or *from* the nervous centres *towards* those parts of the muscular system placed in relation with them.

It is obvious that, if this conclusion were well founded, there could be no *reflex* action of the *vis nervosa*, nor any application of this principle, to physiology,—a very improbable circumstance, *à priori*.

At the same time it appeared to me that, when I had established that the reflex actions did not depend upon sensation and volition, but upon some other principle of the animal œconomy, the only known principle which remained, and which could be the probable agent in these actions, was the *vis nervosa*. I resolved therefore to institute a new series of experiments in order to determine the ques-

* Elementa Physiologiæ, Lausanne, T. iv, p. 325.

† Anatomie Générale, 1801, T. iii, p. 277.

‡ Handbuch der Physiologie, 1834, i, p. 656.

tion, whether the *vis nervosa* were susceptible of other and unsuspected modes of action. To these experiments I will advert very briefly. They afforded the most satisfactory proof that my conjecture was correct, and in a word, that the motor principle of the reflex actions was discovered.

These experiments consist in denuding and stimulating the lateral nerves in the decapitated turtle. Contrary to the law laid down by Haller, Bichat, and Professor Müller, the *vis nervosa*, being excited, acted in an incident direction, that is, *from* branch *to* trunk, and both *upwards* and downwards, and, being *reflected* on the muscles, induced movements in both the anterior and posterior extremities.

It results from these and other experiments, relative to the *vis nervosa*,

1. That it acts in *direct* lines *along* the spinal marrow, and *from* the trunks *to* the branches of the nerves, and *to* the muscles they supply,—according to the law laid down by Haller, Bichat, and Professor Müller.

2. That it acts in *reflex* directions *to* and *from* the spinal marrow; that is, *from* peripheral, cutaneous, and mucous surfaces, *through* the spinal marrow, and *to* the co-ordinated muscles, according to a newly discovered law; and, as will be seen hereafter,

3. That it acts in a *retrograde* direction along the spinal marrow.

Such being the principle on which the reflex actions depend, the next question for this Society is, —in what circumstances are they most manifested in the human frame? From much investigation I

am enabled to state that in order that the *reflex* actions may be very apparent, it is essential

1. That the interference of *volition* should be removed;

2. That the *vis nervosa* and the *vis muscularis* should be unimpaired, not to say augmented, and

3. That the *reflex nervous arcs* should be uninterrupted.

1. That volition interferes with some of the phenomena of the reflex function is obvious from some of the phenomena of sleep and of comatose and paralytic affections. This first principle I had long ago observed; but it is to Mr. W. F. Barlow that the profession is indebted for its more complete developement, in a lecture which he delivered during the last winter, to the students at Sydenham College. Several of Mr. Barlow's observations are extremely interesting; he observes, "I gently passed my finger over the palm of the hand of a child who was fast asleep; the fingers contracted and embraced it tightly, and I could draw the arm away or raise it up, so firm was the grasp. The child having awaked, I again touched its hand as before, but no closure of the fingers was induced." This simple experiment beautifully demonstrates the activity of the excito-motory function during sleep, and the counter influence of volition in the waking state. Mr. Barlow added, "I have remarked that spasmodic actions are induced in limbs paralysed as to voluntary motion, by stimuli which have no such effect on limbs still under cerebral influence."

It is on a similar principle that in cerebral paralysis the reflex actions are most observed in those cases in which the paralysis is most complete.*

2. The first effect of a violent experiment or accident seems to be to suspend the *vis nervosa*, the *vis muscularis*, or both. It is accordingly observed that *immediately* after the division of the spinal marrow, in an experiment, or *immediately* after injury sustained by the same organ in the human subject, by a fall or other accident, the reflex actions subsequently developed and manifested most clearly, are not observed.†

The nervous and muscular powers are gradually restored from this suspension, as the effect of shock, and, at a still more remote period, even acquire an anormal degree of intensity. The phenomena dependent on them are augmented proportionately. The same remark is still more true in regard to cases in which the *vis nervosa* is morbidly augmented by disease, as in tetanus, hydrophobia, certain affections of the spinal marrow, in the effects of strychnine, &c. In these latter cases the slightest cause of excitement is reflected with terrific energy upon the appropriate parts of the muscular system.

3. Lastly, it is essential that the reflex nervous arcs should be entire. It has been observed that in some cases of paraplegia the reflex actions are present, in others absent. A slight knowledge of

* See the Transactions of this Society, vol. xx.

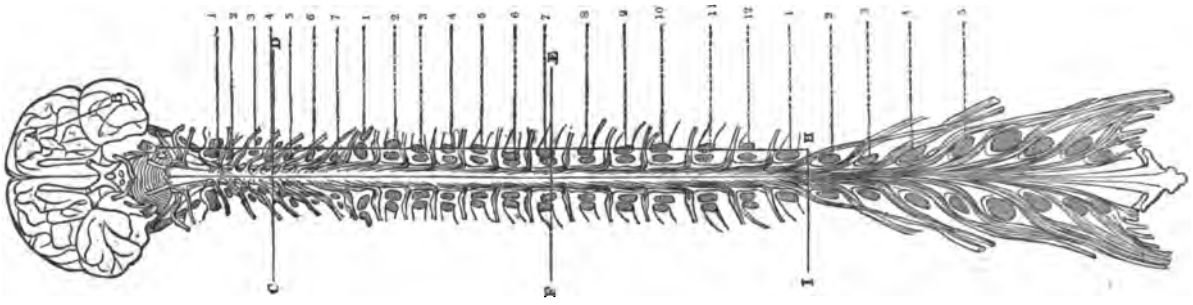
† Ibid. vol. xxii, p. 183.

the anatomy of the spinal column is sufficient to explain this apparent discrepancy. If the disease be seated within the *cervical* or *dorsal* vertebræ, the spinal marrow in this part is affected, but a portion *below* may remain free from the influence of the disease; the reflex arc which involves this portion may, therefore, be entire, and the reflex actions will be observed. If, on the contrary, the disease be situated within the *lumbar* vertebræ, the cauda equina is affected, the centre of every reflex arc is excluded, and all the reflex actions will be absent.

In fact, the lines of *cerebral* and of *spinal* paralysis, drawn in the sketch given in my former memoir and reproduced here, have their application in the consideration of the question before us. In cerebral paralysis, we have reflex phenomena; in spinal paralysis these phenomena are absent. Disease seated in the course of the lines A B, C D, E F, leaves the subjacent reflex arcs, and their functions entire; whereas disease situated in the course of the lines G H, H I, excludes the centres of the reflex arcs and their phenomena respectively.

Very early in this investigation I observed that if the spinal marrow of a frog was divided between the anterior and posterior extremities, the head and the anterior extremities alone were moved spontaneously and with design, the respiration being performed as before; but the posterior extremities were not paralysed: they were drawn up and remained perfectly motionless, indeed, unless stimulated; but by the application of any stimulus, they were moved with

A B, C D, E F—lines of cerebral paralysis, with augmented irritability, and the presence of reflex actions.



G H, H I—lines of spinal paralysis, with diminished muscular irritability, and the absence of reflex actions.

energy, but once only, and in a manner perfectly peculiar. The stimulus was not felt by the animal because the head and anterior extremities remained motionless at the time it was applied. Nothing could be more obvious, and indeed striking, than the difference between the phenomena of the functions of sensation and volition observed in the anterior part of the animal, and those of the reflex function exclusively in the posterior; in the former there were repeated spontaneous movements with obvious design; in the latter, movements which were the mere and immediate effect of stimulus.

The same experiment was made upon the toad, but it did not succeed so uniformly in this animal as in the frog. This circumstance is explained by a reference to the comparative anatomy of the frog and toad. As M. Desmoulins observes, "in the frog the insertion of the lumbar nerves takes place *lower* than in the toad by one fifth of the length of the spinal canal."* In the experiment on the frog, the *spinal marrow* was divided; in the toad it was the *cauda equina*; in the latter case the *key stone* of the incident and reflex arcs was, therefore, excluded, the effect of which is now readily understood. Is it not interesting to see physiological facts, unintelligible, at first, explained by reference to the anatomy, and thus throwing a ray of light upon our pathological investigations?

The very same explanation applies to the cases of

* Les Systèmes Nerveux, tome i, p. 787.

paraplegia, unattended by the phenomena of the reflex excito-motory action. The disease is seated *below* the termination of the spinal chord; it is, therefore, a disease of the *nerves*, and represented by the line H I. The influence of both nervous centres, of the cerebrum, and of the true spinal marrow, is removed, and there are both cerebral and spinal paralysis, and the absence of reflex phenomena.

When M. Magendie divided the fifth pair of nerves within the cranium, the *proof* that the division was complete, was obtained by observing that the eye-lids did not close when the eye-lashes were touched In disease of the portio dura, the same phenomenon is observed. In experiments on the horse, detailed elsewhere, * the eye-lids lost their reflex action when the medulla oblongata was destroyed. In all these three cases the continuity of the reflex arc is severally interrupted, in its incident, central and reflex portion.

The same mode of reasoning applies to the other cases of paralysis, in which the reflex actions are absent.

The nervous arcs through which reflex actions may take place are shown in the following Table of the anatomy of the true spinal system:

* Memoirs, p. 61, § 67.

ANATOMY OF THE TRUE SPINAL SYSTEM.

I. The Incident Motor Branches.
1. The Trifacial, arising from—
1. The Eye-lashes.
2. The Alæ Nasi.
3. The Nostrils.
4. The Fauces.
5. The Face.
2. The Pneumogastric, from
1. The Pharynx.
2. The Larynx.
3. The Bronchia.
4. The Cardia,—Kidney, and Liver.
3. The Posterior Spinal, arising from—
1. The General Surface.
2. The Glans Penis or Clitoridis.
3. The Anus.
4. The Cervix Vesicæ.
5. The Cervix Uteri.
6. The Extremities.

II. The True Medulla Oblongata and Medulla Spinalis, the Centre of the System.

III. The Reflex, Motor Branches.
1. The Trochlearis } Oculi.
2. The Abducens }
3. The minor portion of the Fifth.
4. The Facial, distributed to
1. The Orbicularis.
2. The Levator Alæ Nasi.
5. The Pneumogastric or its Accessory.
1. The Pharyngeal.
2. The Œsophageal and Cardiac.
3. The Laryngeal.
4. The Bronchial, &c.
6. The Myo-glossal.
7. The Spinal, distributed to the
1. Diaphragm, and to
2. The Intercostal and } Muscles.
3. The Abdominal }
8. The Sacral, distributed to
1. The Sphincters.
2. The Expulsors, the Ejaculators, the Fallopian Tubes, the Uterus, &c.
3. The Extremities.

I may here add the remark that the presence of the reflex actions coincides with that of augmented irritability of the muscular fibre, described in my former memoir, whilst their absence coincides with the diminution or annihilation of the muscular power.

Such being the principles which regulate the presence or absence of the reflex phenomena in disease, I shall now proceed to make some observations on the diseases themselves, in which these phenomena are displayed, and to give a series of cases in illustration, in the same sketchy manner as in my former memoir.

I. OF DISEASES OF THE HEAD.

In the coma of apoplexy, of epilepsy, and of hydrocephalus, we observe, according to the *degree* of the affection, the diminution of the cerebral, and of the cerebral and true spinal functions. The test is supplied by the eyelids. In the slighter forms of coma, the eyelids are frequently but partially closed, yet they close perfectly on touching the eye-lashes; in the severer forms of this affection, not only the cerebrum, but the medulla oblongata, has its powers impaired, and the eyelids do not close, although touched.

CASE I.

I carefully watched the progress of hydrocephaloid symptoms in the case of a little boy aged four. The eyelids closed imperfectly when he was undisturbed, but quite perfectly when the eye-lashes were touched with a pencil. This phenomenon ceased as the symptoms became aggravated, and returned as they were again mitigated.

CASE II.

I visited a patient affected with the deep stupor left by a violent epileptic attack. I dashed cold water in his face without inducing inspiration; I

touched the eyelid without inducing its closure; a little water poured into the mouth excited cough and was swallowed with difficulty; twenty ounces of blood were drawn from the arm, and the same experiments were made as before; the patient sobbed when cold water was thrown upon his face; the eye-lids closed on irritating their border, and deglutition was comparatively easy.

The condition of the larynx, of the pharynx, of the respiration, of the sphincters, is similarly affected; and it may be remarked, in general, in regard to cerebral diseases, that they are less or more aggravated, according as the cerebral functions only, or the true spinal functions also, are affected. Impaired deglutition and respiration are, therefore, symptoms of the most serious import in cerebral diseases.

II. OF HEMIPLEGIA.

The reflex actions are not less observed in cases of hemiplegia than in cases of paraplegia; but as they are, in general, more obvious the more complete the paralysis, and as the paralysis of hemiplegia is, in general, less complete than that of paraplegia, they have been less observed in the former affections.

CASE III.

In one case of hemiplegia so nearly complete that

the patient could only move the toe very slightly, forcible retractions of the foot and leg were produced by tickling the sole of the foot, or by applying a spoon, just taken out of hot or cold water, to the leg.

CASE IV.

In a case of hemiplegia, occurring in a child five years old, in which voluntary motion was entirely lost, sensation remaining, the following phenomena were noticed by Mr. Barlow:—"When the paralytic arm or leg was pinched, it was convulsively retracted, and on the sole of the foot being tickled, the leg was bent with much energy, and at the same time the upper extremity of the hemiplegic side was thrown into spasmodic action. The application of heat and cold alike produced reflex actions. The hand was immersed in water at the temperature of 90°, 120°, and 140°. In the first case no muscular movement was perceived; in the second there were forcible spasmodic actions; in the last instance they were still more violent.

"Dashing cold water on the face or chest, occasioned convulsive movements of the paralytic limbs. Nothing could be more marked and evident than the effect of emotion upon the paralysed extremities. On exposing the chest and dipping my hand into water, for the purpose of sprinkling some drops upon the skin, the child, inferring my intention from what had happened previously, cried violently,

and at this time there were movements of the arm and leg, similar to those which were excited by heat, cold, &c. The half of the body in which the power of the will was unimpaired, participated not in these actions, even when they were most violent."

I have already noticed the occurrence of reflex actions in hemiplegia (see the case given in my former Memoir, Med. Chir. Trans., vol. xxii, p. 211), and in a case of hemiplegic loss of power of the hand, after severe attacks of epilepsy, of which I insert a brief outline here:—

CASE V.

W. W., aged twenty-one, had suffered a degree of loss of power of the left arm and leg, from repeated and protracted epileptic seizures; he could not close the left hand firmly otherwise, but immediately grasped any object placed in the palm with considerable force.

CASE VI.

An interesting example of reflex actions in hemiplegia is given by Dr. Baly, in his translation of Professor Müller's Physiology, vol. i, p. 721, note:—

Dr. Baly observes, "The translator has now under his care, at the St. Pancras Infirmary, a woman aged fifty-three years, recently attacked with hemiplegia, (complete loss of sensation and motion

in the left upper and lower extremity,) in whom, nevertheless, pinching or even slightly touching the sole of the foot or ancle of the paralyzed leg, caused the limb to be retracted and the toes extended, the patient being unconscious both of the stimulus and of the movement. The phenomenon is here the more striking, as in the opposite leg, which possesses its full voluntary power, no spasmodic contraction is produced, although the slightest touch is felt."

CASE VII.

Another interesting fact of the same kind is given by Dr. Holland in his elegant "Medical Notes and Reflections," (p. 324, note.) "At this time," says Dr. Holland, "I am attending a patient who is scarcely able to raise his right arm to his chin, in effect of a hemiplegic attack three years ago; but in whom the dressing of a seton, near the lumbar vertebræ on the same side, often twitches the arm so forcibly as to raise it to a much higher level. In the same patient, when yawning, the fingers of the right hand become suddenly extended, though at other times bent closely and tightly inwards, without any power of opening them by voluntary effort." *

* It would be ungrateful in me not to express my obligations to Dr. Holland for the kind manner in which he has spoken of my labours in his elegant "Notes and Reflections," (see pp. 149, 323, 602, 606). I am not less indebted to Professor Sharpey, for the equally kind manner in which he has spoken of these investigations, in his Lectures at University College.

In cases of hemiplegia, the paralytic arm has been agitated in passing the urine or fæces.

CASE VIII.

Mr. F., aged about fifty-five, was seized, three months ago, with apoplectic symptoms, which left pretty complete hemiplegia. At first there was a little stertor and a little dysphagia; but these symptoms ceased with the apoplectic state, the former at once, the latter a little more tardily. There was also slight enuresis for several days. On tickling the sole of the foot, or pinching the skin, or pulling a hair of the leg, and on applying a spoon just taken out of hot or cold water, there were distinct sudden movements of the leg. The same thing occurred in regard to the arm, but in a less marked degree. On first applying galvanism, the paralytic arm was least affected; the effect, I suppose, of the shock of the disease; afterwards the paralytic arm was most moved, as in other similar cases. On the same principle, the effect of emotion, as laughter, was at the first more observed on the healthy than on the paralytic side of the face; more remotely, the equilibrium of the countenance, under the influence of laughter, was restored, or nearly so. At this time, the arm, and especially the hand, are paralysed to voluntary motion, but readily agitated by emotion, and sudden or energetic respiratory efforts, and constantly contracted, as by a spring, the arm towards the trunk of the body, the fingers towards

the palm of the hand; and, lastly, more agitated by the influence of galvanism than the unaffected limb. The voluntary power of the arm is much less restored than that of the leg, in which the phenomena just enumerated are, comparatively, absent.

Sensation is far less affected than the power of voluntary motion.

The influence of certain acts of respiration, of emotion, of the principle of tone, &c., on hemiplegic limbs, though belonging to the spinal system generally, does not belong to the reflex actions, the more immediate object of this memoir. Briefly adverting to observations made in my former memoir, (Med. Chir. Trans., vol. xxii, pp. 207–208, 210–211,) therefore, I shall proceed to notice the case

III. OF PARAPLEGIA.

Under this head I shall very briefly adduce the various cases of reflex action which have been published, in the order in which they appeared. The phenomenon is now become familiar to every observer.

I believe the first observation of this kind was made by Dr. Macartney of Dublin, and it was communicated by him to Sir Benjamin Brodie, and by this latter gentleman to this Society. To Dr. Macartney I am indebted for the following note:—

"My dear Sir,

"In reply to your letter I have to say, that Sir

Benjamin Brodie very accurately stated the fact as I had communicated it to him, respecting the priapism which is so apt to be produced by injuries of the spinal marrow. In the case to which he alluded, the man injured the spine by falling into a quarry. The erection of the penis was very violent immediately after the accident, and occurred at intervals, for several weeks afterwards, especially on the slightest friction of the glans penis, so as to create much inconvenience in the introduction of the catheter. He had no consciousness of what was going on, unless he put down his hand to the part, or looked at it.

" I have seen similar cases of erections after injury to the spinal marrow, but not in so extreme a degree; and I have observed a violent priapism in two men who were suffering death by hanging.

" I am, very truly yours,

" J. MACARTNEY.

" Upper Merrion Street, Dublin,
" March 29, 1838.

" To Dr. Marshall Hall."

Sir B. Brodie has confirmed this remark by his own observation. He observes, " Priapism occurs even where the sensibility is entirely destroyed, and may be induced by the mechanical irritation caused by the introduction of the catheter, where the patient is entirely unconscious of the operation. This circumstance was pointed out to me, many years

ago, by Professor Macartney, of Trinity College, Dublin; and I have had many opportunities of verifying the correctness of the observation."*

The next observation of this kind is by Mr. Mayo, who has observed, in his Outlines of Pathology, (1835, p. 154,)—"In some cases of privation of sense and motion in the legs, through disease affecting the middle of the spinal cord, I have seen so much independent power remain in them, that pricking or tickling the foot, which yet excited no sensation, and was unknown to the patient, was nevertheless followed by its retraction."

I believe we possessed no published facts of this kind before the attention of the profession was excited to them by my first publication on the subject of the Reflex Function of the Spinal Marrow, in 1832. Since that time, however, they have accumulated.

Mr. Barlow and Dr. W. Budd each communicated to me a case of reflex actions in paraplegia, about the same time, in 1836. I was indebted for a third to Dr. Elliot of Carlisle; a fourth I visited by the invitation of Mr. Liston, at University College Hospital, and a fifth on board the Dreadnought, with Mr. Busk. I have since seen a considerable number.

Mr. Barlow's case is the first observed, and published with a view of illustrating my investigations

* Med. Chir. Trans. vol. xx, for 1836, p. 140.

into the nervous system, and as it is, at the same time, the most complete, I shall give it in his own words :—

CASE IX.

" John Bright, aged nineteen, on the first of October, climbed up a walnut tree, for the purpose of picking the fruit, and when he had attained a very considerable height, slipped, and was precipitated to the ground. He was soon afterwards found, in a cold and pulseless condition, with his lower extremities numb and motionless. These symptoms at first naturally led to the supposition, that there was a fracture of the spine, but examination gave no proof of it, and afforded no evidence of displacement: there was, however, a slight swelling in the situation of the two or three first dorsal vertebræ, and pressure there was attended by pain. He was much depressed by the violence of the shock, and his articulation was faint and indistinct. A few hours after, he had rallied, and complained of pain in his head, and giddiness, which were relieved by moderate depletion. There was obstinate costiveness of the bowels, which was overcome by strong purgatives; and retention of urine, which required the introduction of the catheter; and it was necessary to repeat this operation at proper times, for a month after the accident; subsequently to which, the bladder became incapable of retaining its contents. Although every attention has been

paid him, sloughs have formed in the integuments of the back.

" The following is the present state of the patient, three months after the accident:—The lower half of his body and inferior extremities are entirely *devoid of sensation*, and they are *not*, in the slightest degree, *under the influence of* the will; sometimes the patient has cold shiverings; and whilst the muscles of that part of the body supplied with nervous energy from above the seat of injury are observed to shake, those deriving their nerves from below that spot are perfectly motionless. This has been often remarked by his mother, who waits upon him.

" Notwithstanding the anæsthesia, and the patient's inability to effect a single movement through the medium of volition, when the integuments of the legs are *pinched*, or more particularly when the sole of the foot is *tickled*, the extremities are retracted with considerable force. A little *cold water* dashed upon the surface has the same effect, though there is no feeling of coldness. The leg is constantly in the flexed position; and if straightened, recovers it again. When the *catheter* is introduced, the penis is excited into a state of complete erection, and this is invariably consequent upon the gliding the instrument along the urethra: at the same time the legs are drawn up, and a twitching of their muscles is very obvious.

" That the muscular contractions, so easily excited by various stimuli, are referable to the reflex

function of the medulla spinalis, cannot but be admitted. In this case, all communication between the *brain* and that part of the chord from which the lower half of the frame derives its nervous power is, so far as function is concerned, effectually cut off; therefore, to the agency of the *spinal marrow* are owing those movements of which the mind knows nothing, and which, at first sight, *seem* to denote the perception of an irritating cause, and the wish to avoid it; though, upon inquiry, it is found that no sensation whatever exists.

"The situation of the different portions of the fractured bones, and the condition of the spinal marrow within, observed on a post-mortem examination, show that the influence of the cerebrum must have been separated from the parts below the injury. The spinal marrow was nearly severed in the neck."

Dr. W. Budd's case is already published at length in the Society's Transactions (see vol. xxii, p. 154), and need not, therefore, be reproduced here.

CASE X.

In the order of time, Dr. Carpenter's case must next be noticed. It was published in the Edinburgh Medical and Surgical Journal, No. 132. It was observed by Mr. Madden. Mr. Madden says,—"In the Autumn of 1834, I was in attendance upon a case of complete paraplegia, in which it was necessary to employ the catheter twice daily. On se-

veral occasions, when the point of the instrument was passing the prostatic portion of the canal, where a slight obstruction existed, I observed that the patient jerked his legs violently; but upon inquiry he positively denied having experienced any sensation, being not even conscious of the presence of the instrument in the urethra. The disease appeared to have been originally induced by two severe injuries received a twelvemonth before. Upon dissection, the spinal cord in the lower part of the dorsal region, was found completely disorganized, being converted into a semi-fluid pulp. The preparation has been placed in the museum of the College of Surgeons."

Dr. Elliot's case is of great interest. It was one of spinal curvature, with a fluctuating swelling in the region from the fourth to the seventh *dorsal* vertebræ, with *paraplegia* and *rigid flexure* of the lower limbs.

The loss of sensation and of voluntary motion was complete, but "powerful involuntary movements were produced in various ways."

I am indebted to Dr. Elliot for the following interesting account of it.

CASE XI.

"There appeared to be no *sensation* from a little above the crest of both ilia downwards, on pinching, rubbing, or scratching with a pin. Friction with the hand over those parts of the *abdomen* devoid of sensation, and over the ilium, on the right side,

produced, when the girl lay on the left side, powerful *extension* of the right leg and thigh, *i. e.*, the limb, if previously bent, became straight, and was forcibly moved backwards. Friction over the *sacrum* caused instant *flexion* of the knee and thigh; friction of the corresponding surfaces on the left side produced very irregular motions of the left lower limb."

An interesting case was communicated by Mr. Barron to Mr. Grainger, and published in the latter gentleman's work "On the Spinal Cord," (p. 94).

CASE XII.

"A girl, about fifteen years of age, who was a patient of Mr. Crosse, at the Norfolk and Norwich Hospital, a few years since, was affected with angular curvature of the spine, producing insensibility and paralysis of the lower extremities. On tickling the *soles of her feet*, which as an experiment was often done, the legs were immediately slightly retracted, although the patient said she felt nothing; it was further remarked that on touching the *other parts of the feet* or *the legs*, in the same manner, no effect was produced."

I am indebted for the following case to C. Slee, Esq., Middlesbro', Yorkshire.

CASE XIII.

"John Alderson, aged twelve, is a most intelli-

gent boy, of strumous habit. About six months ago a tumour was observed *between the scapulæ*, and a short time afterwards he became unable to walk without falling, even on a level floor. Soon after this he ceased to have the power of lifting his feet from the ground, when in the sitting posture. On pinching the feet and legs, I was astonished to find that each attempt caused violent involuntary startings of the limb, which were very painful. The sense of touch appeared to me to be even more acute than natural in every part of the lower extremities. I was informed that a current of cool air, on coming in contact with the limbs, frequently gave rise to the same phenomenon as that caused by pinching."

CASE XIV.

In a case read by Mr. Obré, before the Royal Medical and Chirurgical Society, on March 17, 1840, of hemiplegia from tumour in the pons varolii, in a boy nine years of age, both the paralytic limbs, but especially the leg, were much agitated, and priapism excited by passing the catheter.

But I need not occupy the attention of the Society by any further detail of cases of this kind, especially as I have it in my power to remind them of the admirable and invaluable "Contributions to the Pathology of the Spinal Cord," published in the last volume of its Transactions, by Dr. William Budd.

IV. TETANUS; HYDROPHOBIA; EFFECTS OF STRYCHNINE.

As in cerebral paralysis we have augmented irritability of the muscular fibre, or of the *vis insita*, in tetanus and hydrophobia we have the *vis nervosa* morbidly augmented, but in an infinitely greater degree.

The slightest external stimulus is sufficient to excite reflex actions in their most terrific forms.

What is remarkable is, that it is precisely the functions of the orifices and sphincters, of the ingestors and egestors, which are most affected in these formidable diseases; and, most of all, the larynx, the pharynx, the organs of respiration, and the rectum.

The remarks which have been made relative to the condition of the reflex function in tetanus and hydrophobia, apply equally to that artificial tetanus induced by strychnine. In a report of La Charité, of Berlin, drawn up by Dr. Köhler, it is observed that "in some individuals, the sensibility to external impressions, under the influence of strychnine, was so great, that they broke out into an almost uncontrollable fit of laughter on being touched with the finger."*

* Lancet for October 1836.

V. UNDUE EXCITABILITY.

Instead of paraplegia, and the other forms of paralysis, arising from disease of the spinal marrow, we have occasionally undue excitability. I think this subject has not been sufficiently treated of in medical writings. But I can only briefly notice it here in connection with the main subject of this paper. On another occasion, I may beg the attention of this Society to it more particularly. It is still a question how far the spinal marrow is primarily or organically affected in these cases; which I think quite distinct from those of common paraplegia.

CASE XV.

In one interesting case, (which was once seen by our President), there were movements of the fingers somewhat like those seen in chorea, whilst the muscles of the legs were spasmodically contracted; the patient was as incapacitated for muscular exertion as in paraplegia. The point to which I wish particularly to allude here is this,—the skin was so susceptible to impressions in certain parts of the surface, that the patient was affected with a sort of general emprosthotonic spasm, with a slight sob whenever the bedclothes, for instance, were drawn over his chest, and still more especially when the

penis was accidentally touched in a similar manner. Similar effects were observed on applying the pure potassa to establish an issue along the spine. The legs were drawn upwards whenever the sole of the foot first touched the cold floor on rising in the morning.

In another case, in which there was a peculiar dysphagia, which I propose to describe more particularly hereafter, together with inability to use the lower limbs, the susceptibility of the skin was such, that the touch of the left side of the thorax by a coarse towel produced the most painful and intolerable "*shudder.*"

VI. PECULIAR DYSPHAGIA.

I have met with three cases of the peculiar form of dysphagia to which I have just alluded. From an undue excito-motory action, the pharynx seizes some solid portion of what is attempted to be swallowed, and this is afterwards returned by a peculiar effort, for which I know of no designation but that of a forcible hawking. A pill, though taken with a large draught of water, is arrested at the upper part of the pharynx. A little of the core of apple, or of the gristle of meat, is seized and retained in the same manner, the rest being duly swallowed. Sometimes large portions of food are thus retained. When the pharynx is thus occupied by a portion of food, it is necessary to remove it either by swallowing

some fluid, or by the effort just described. It may not be without interest to add, that I am myself affected with this singular kind of dysphagia.

VII. MORBID ACTION OF THE RECTUM AND BLADDER, AND OF THE SPHINCTERS.

There is a peculiar affection of the rectum and bladder in some nervous affections, of which the following experiment affords both the type and illustration: if, in a turtle, after the removal of the tail and the posterior extremities, with the rectum, and, of course, with a portion of the spinal marrow, water be forced into the intestine by means of Read's syringe, both the cloaca and the bladder are fully distended before any part of the fluid escapes through the sphincter; which it then does only on the use of much force, and *by jerks*. If, when the cloaca is distended, the integuments *over it* are stimulated, the water is propelled to a considerable distance.

When the rectum or bladder is distended, the patient feels a sudden call, and the action of the expulsors is so energetic, or the power of the sphincters is so diminished, that unless the call can be promptly obeyed the fæces or urine escapes.

In tenesmus and strangury, the sphincter of the rectum and of the bladder is excited to undue contraction respectively. A ligature applied to hæmorrhoïds not uncommonly induces spasmodic action of the cervix vesicæ and retention of urine. In one case,

calculus of the bulb of the urethra induced spasmodic stricture of the sphincter ani. All examples of morbid reflex action.

VIII. SINGULAR ACTION OF THE THORACIC AND ABDOMINAL MUSCLES.

CASE XVI.

In an interesting case it was observed that, whenever the rectum was more than usually fretted, the muscles of the thorax and abdomen were drawn into violent action, especially the serrati and the recti; the insertions of the former, and the division of the latter, were marked as we observe them in certain pictures and statues.

I now beg to draw the attention of this Society to another subject,—the localization of the effects of certain remedies, if I may use this expression.

The localization of certain remedies is highly worthy of observation: strychnine acts upon the glottis, cantharides on the neck of the bladder, aloes on the rectum, the secale cornutum on the uterus,—all organs specially under the influence of the excito-motory power and reflex function of the spinal marrow.

I shall illustrate this subject, as before, by briefly adducing the particulars of two most interesting cases.

CASE XVII.

Strychnine.

A lady, being at Lausanne, in September 1836, consulted a foreign physician there, who prescribed the strychnine; I do not know the dose; I only know that it was afterwards *diminished* to one-tenth of a grain thrice a-day. Two pills were taken at bed-time, and three the next morning; soon after which, the patient was taken with spasm of the muscles about the larynx, and those of one arm. She felt as if strangled. With much effort she mixed some *eau de Cologne* with water, "snapped at it," and so swallowed it. She was shortly relieved. The dose of strychnine was repeated between breakfast and noon. The same symptoms were renewed; she *felt* and *looked* as if strangled. The muscles on each side of the larynx became tense, like cords; she was again relieved by *eau de Cologne*, which she took hastily, as before. After this, the dose of strychnine was reduced, as I have stated, and was taken without any bad effect.

For the following interesting case I am indebted to Mr. Robarts, of Everett Street, Russell Square.

CASE XVIII.

Cantharides.

A young lady, aged 27, had a fatty tumour within the tenth and eleventh dorsal vertebræ; it gradually,

but completely, severed the spinal marrow, and induced perfect paraplegia. The bladder lost its power of retention. The singular fact in this case was the following.—On giving a dose of tincture of cantharides the power of retaining the urine was always restored *for the time.* This power would cease, and again be restored, on suspending or repeating the medicine.

It is obvious that the cantharides acted through the segment of the excito-motory system, left below the division of the spinal marrow.

What strychnine effects in regard to the larynx and pharynx, cantharides effect in regard to the cervix vesicæ: the reflex function of these parts is notwithstanding augmented, and stimuli, which have no such effect naturally, induce morbid and even spasmodic actions. I need not illustrate the special and local action of aloes, or of the ergot, by any cases.

On the other hand, certain localities are more susceptible than others to the effects of the excito-motory stimulus: the sole of the foot is especially one of these; Dr. Little has published in his Thesis an interesting case of distortion of the foot, which only, but uniformly, occurred when it was placed upon the ground.

CASE XIX.

"Juvenis quidam si planta pedis humum attingebat, spasmo tonico gastrocnemiorum afficiebatur,

quo calx sursum trahebatur. Sin æger sella sedebat vel supinus jacebat, pedem naturali modo undique movere et gastrocnemiis prorsus imperare potuit. Quoties vero digitis humum tangebat, ut infra fusius retulero, gastrocnemii spasmodice contrahebantur."

Dr. Duffenbach met with a similar case.

The sides of the thorax are most susceptible to the singular effects of tickling, and to the augmented susceptibility or excitability of which I have briefly sketched two cases.

Having thus illustrated the subject of the morbid reflex actions, I must proceed to another object of this paper, viz., to point out the comparative effects of the different excitants of the reflex function.

THE EXCITANTS OF THE REFLEX ACTIONS.

The fœtus in utero is so little exposed to the influence of stimulants or excitants applied to the cutaneous or mucous surfaces, that the excito-motory property is *comparatively*, little called into action in the form of the reflex function. The contact of the liquor amnii may preserve the lips or the larynx, and the sphincter ani, closed. In this manner the reflex function or the function of exclusion and of retention is in activity; but as the agent in ingestion and egestion, it is as if it did not exist.

It is on the expulsion of the fœtus, and by the contact of the atmospheric air with the minute distributions of the incident nerves of the excito-motory

system, that the functions of ingestion and egestion first commence.

It is, doubtless, from the impression of the atmospheric air on the trifacial and spinal nerves, distributed upon the surface of the face and body, that the first inspiration is excited. My friend, Dr. Heming, in attendance on a case of labour, waited, after the delivery of the child, for the usual sign of respiration and crying. This did not take place; and Dr. Heming began to feel a little anxiety for the infant's safety. On the point of proceeding to the use of some means of resuscitation, he raised the bed-clothes, and of course admitted the atmospheric air into contact with the infant's skin. Inspiration was instantly excited, and the little patient continued to breathe.

The influence of cold water dashed on the face, and the influence of the diffused contact of the cold bath, in exciting sudden sobbing acts of inspiration, are well known.

The same contact of cold air which excites the first inspiration, also excites the first acts of expulsion of the fæces and urine. This effect is also seen in the late periods of existence. The cold bath induces the same effect. I have observed animals, on being driven through a cold stream, invariably to evacuate the rectum and bladder. Cold water, injected into the rectum, is sometimes expelled with force. The same effect was produced in one of Dr. William Budd's patients,* on injecting cold wa-

* Medico-Chirurgical Transactions, vol. xxii, p. 182.

ter into the bladder. Might not this remedy be used with advantage in uterine hemorrhage?

Not only the bladder and rectum, but the uterus is subjected to the same influence. The catamenia are apt to be suddenly checked by the influence of cold. The uterus is excited to contraction and uterine hemorrhage is most distinctly arrested by an effectual douche of cold water.

I may here advert to the *diffused* influence of a mere *partial* application of cold upon the skin. The pores over an extensive surface are closed, and the perspiration arrested. Is this a *muscular* phenomenon, belonging to the reflex excito-motory system?

It is interesting to observe the salutary effects of a new exposure of a fœtus at the precise moment when new functions are required. It is also interesting to observe the influence of the same cause at subsequent periods of life, and in certain cases of morbid affection. Of the latter, none are more remarkable than the phenomena observed in the coma of epilepsy and apoplexy. The medulla oblongata being compressed, together with the other contents of the cranium, the influence of dashing cold water on the face may be absolutely null: on taking off that pressure by blood-letting, the susceptibility to the influence is again restored: it becomes a measure, even, of the diminished compression.

There are other influences of cold, which must not be passed over unnoticed. Free exposure of the

face to the cold breeze is the most effectual remedy in sickness, and affords manifest relief in asthma.

As to other excitants of the reflex functions, we need only call to mind the simplest facts. The nipple or the finger, introduced between the lips of the new-born, or even the anencephalous, fœtus, immediately excites the act of sucking: the mere introduction of the enema pipe into the rectum of an infant, equally excites the action of the rectum. The irritation of a few grains of common salt, applied to the border of the sphincter ani, will induce the premature expulsion of an egg in a common fowl.*

I need scarcely allude to food as the natural exciter of the pharynx, œsophagus, and cardia, or to the fæces and urine, as the equally natural exciters of the expulsors about the rectum, and of the bladder.

It will be observed that in *all* these cases the excitant is applied to *cutaneous* or *mucous* surfaces: these surfaces are, indeed, the only surfaces exposed to the action of external stimuli: some internal textures are, however, capable of transmitting the influence of excitants. I have seen the limbs of the decapitated turtle moved energetically on dividing internal tissues; and I have known spasmodic affections induced by disease of similar internal tissues; of which the cases published in the Transactions of this Society, in its twenty-second volume, p. 1, by Dr. R. Bright, may be examples.

* The same effect is said to have been produced by the secale cornutum, in an experiment performed by M. Velpeau.

It still remains for us to trace the influence of excitants of this function in some more hidden cases. It is almost certain that the gall-ducts, the ureters, and other excretory canals, are endowed both with incident and excitant, and with reflex and motor, nerves. The passage of a biliary or urinary calculus *excites* vomiting: exposure to cold, a loaded intestine, certain passions, and in infants mere dentition, will, on the other hand, arrest the flow of bile and induce icterus.

The influence of the excitants of this system of actions, considered as *remedies*, is little known. One of the most interesting examples of this kind is that of the application of cold to the face and to the general surface, in some cases of suspended animation. As a remedy in the cases of the still-born fœtus and of drowning, the sudden contact of cold water is most important. I have already alluded to the use and influence of the cold water douche in cases of hemorrhage from inaction of the uterus.

Physiology is still in need of a series of experiments upon the comparative influence of the several excitants, especially cold, heat, and *mechanical irritation*.

It only remains for me to observe here what are the agents which most effectually excite the reflex actions in disease, and especially in the cases of cerebral paralysis. A metallic spoon, taken out of cold or hot water, and suddenly applied, the pulling of a hair, the prick of a needle, the titillation of a feather, are the means which most naturally

suggest themselves as tests of the excito-motory actions in cases of paraplegia.

The subject of tickling ought to be treated more at length, but I refrain from doing so for fear of wearying the attention of the Society.

II. RETROGRADE ACTION IN SPINAL DISEASE.

The subject to which I now venture to call the attention of the Society, is involved in the deepest obscurity.

It has been observed in certain experiments, which I shall detail very briefly, that an irritation of the middle part of the spinal marrow, below the origin of the brachial plexus, induces in some decapitated animals, and especially the cold-blooded and the very young of the warm-blooded, distinct movements of the anterior extremities.

I removed the head of a young turtle: on pinching and galvanizing the lower extremity of the medulla oblongata, there was an excited act of inspiration. The same event occurred on stimulating the nostril, the intra-maxillary or palatine fringes, and the internal part of the larynx.

I then laid bare the middle portion of the spinal marrow by removing part of the shell. On pinching or galvanizing this, *both* the *anterior* and *posterior* fins were moved.

I took a frog, separated the head, and divided the spinal marrow low in the back: I then stimul-

ated the lower end of the upper portion of the spinal marrow with the forceps; the anterior extremities moved in the most remarkable manner:—they were gently raised, without being affected with the *twitchings* seen in the inferior extremities when the upper part of the lower half of the divided spinal marrow was stimulated.

I was next anxious to perform these experiments on an animal of warm blood. I chose for this purpose a rabbit of six days old.

I first removed the head. I then stimulated the lower end of the divided medulla. There was an immediate act of *gasping*; I then divided the spine in the back, and stimulated the lower end of this middle portion of the spinal marrow; the anterior extremities were immediately moved.*

In reference to the question, whether retrograde actions of the spinal marrow take place in disease, that is, whether spasmodic or other morbid action occurs in disease of the spinal marrow *above* the seat of the disease,—I must content myself by a brief reference to one or two English works, and by a brief extract from the "Memoirs" of M. Louis.

In Mr. Copland's "Observations on diseased Spine," published in 1815, p. 47–50, there is a case in which disease seated in the lower part of the dorsal region affected the upper extremities.

* Similar experiments have been performed by M. Flourens and Prof. Müller; but in these the *head* was not removed; so that the effects might be complicated with the effects of sensation and volition.

This case is mentioned and confirmed by Sir B. Brodie in the *first* edition of his "Observations on Diseases of the Joints," in 1818; but the subject is omitted in the *third* edition of that work, in 1834; from which we may conclude that the author had subsequently learnt to doubt the accuracy of the observation.

In the "Memoirs" of M. Louis I find the following interesting observation, in relation to a case of caries of the third and fourth *dorsal* vertebræ;—"Les bras, déjà faibles dès l'entrée de la malade à l'hôpital, furent comme paralysés dans les trois derniers mois qu'elle y resta; ses mains étaient constamment fléchies, mais ses avant-bras jouissaient de quelques mouvemens: elle éprouvait des douleurs aux épaules, aux coudes et aux poignets; elle en eut de très-vives dans les deux derniers mois aux épaules, et peu après son arrivée à Saint-Germain, la tête s'inclina du côté gauche, et garda constamment depuis, la même position. L'appétit avait peu diminué, les selles avaient été plus rares que fréquentes, et dans les quinze jours qui précédèrent l'entrée de la malade à la Charité l'émission de l'urine fut difficile.

"Le 13 Novembre, tête inclinée à gauche, figure assez animée; paralysie des bras; douleurs dans toute l'étendue des avant-bras, et jusqu' à l'extrémité des doigts, lancinantes, augmentées par le mouvement." (See "Mémoires sur plusieurs Maladies.")

At p. 427, M. Louis adds, "Mais comme, dans les observations où règne le plus grand accord entre les symptômes et les causes auxquelles on doit les

rapporter, il n'est pas toujours possible de se rendre compte de tout, nous ne chercherons pas à expliquer pourquoi, dans le cas dont il s'agit, la douleur de l'épine n'a eu lieu que dans les trois derniers mois de l'affection ; ni comment le ramollissement de la mœlle existant au niveau des troisième et quatrième vertèbres dorsales, les bras étaient paralysés, tandis que les avant-bras jouissaient de quelques mouvemens. Ces différens objets sont encore pour nous des anomalies ; et resteront peut-être tels, fort longtemps."

The only other observations which I shall adduce at present are taken from Mr. Stafford on the spine.

CASE XX.

"October 1831.—A man fell from the top of a waggon-load of hay ; he had struck his back upon the *second, third* and *fourth* lumbar vertebræ, which were considerably displaced laterally, the body leaning to the right side, leaving but little doubt that the spine at that part had suffered fracture. He was perfectly paralysed below the injury ; the fæces escaped involuntarily, and the bladder could not expel its contents ; the arms likewise were partially paralysed, in both the powers of feeling and motion. His present state is as follows :—the muscles of the right arm are so *contracted* that it is closely fixed to the side ; the fore-arm, from the same cause, rests upon the humeral part ; the wrist is bent on the fore-arm, and the fingers are firmly clenched in the palm of the hand ; the sense of feeling is partially lost ; the

left arm is affected in the same manner, but not in so great a degree; the right leg has both the power of motion and feeling; the left leg has the power of feeling, but not that of motion; the sphincter muscle of the rectum remains paralysed, the fæces still escaping involuntarily, and the bladder only expelling half its contents.

"The various symptoms just related are certainly very extraordinary, and had it not been for the discoveries of modern physiologists, they could not have been accounted for; and even as it is, some of them are still involved in great obscurity. For example, how can we for certain explain why, in one case, the arms alone should be paralysed; in another only the bladder and rectum, and one leg partially; and in a third, that the parts above the place where the blow was received, should suffer as well as those below? Such phenomena cannot be satisfactorily accounted for, and the only attempt at elucidation we can offer is, that the origins of those nerves, or that particular part of the substance of the medulla with which they are connected, supplying the parts affected, have more particularly suffered."

It is obvious that the question agitated in this place is one of great moment in the diagnosis of diseases of the spine; for if there be in disease or accident, retrograde influences of the spinal marrow, we must not always conclude that the disease or injury is situated *above* the origin of the nerves affected. It is equally obvious that the whole subject needs new and accurate observation.

I trust that one advantage will arise from the brief remarks which have been made in this communication, viz., that in every case of cerebral or spinal disease, and disease of the nerves in their course, the condition of the reflex actions, and of the retrograde influences of the spinal marrow and nerves, will henceforth be carefully examined. The first of these subjects has already made great progress; the second has scarcely been touched upon in medical writings. I will venture to suggest that cases of caries of the vertebræ appear to afford the most probable example of diseases *limited* to a given region of the spinal marrow, and therefore the best for the latter kind of inquiry. They afford examples of *irritation* before morbid processes have induced *disorganization*. The questions to be considered are two. 1. Is there paralysis? 2. Is there spasmodic action, in parts receiving their nerves from portions of the spinal marrow *above* the seat of the disease?

The time is already arrived when it is impossible to examine a case of cerebral or spinal disease without a distinct reference to the sentient and voluntary and the excito-motory phenomena. The cases taken and recorded before this distinction was clearly pointed out, are already felt to be inadequate to fulfil the demands of observation. The subject must be resumed: observations must be made anew, with constant reference to the distinctions which I have established, before all the evidence which they afford can be said to be derived from them.

Inferences.

I will conclude this paper by submitting to the Society the following propositions or inferences.

1. It is proved by the series of facts which have been observed in the human subject, that the excito-motory reflex actions are independent of sensation and volition, however they may be accompanied by sensation, or influenced by volition, in the perfect animal.

2. It is proved as a consequence, that the reflex actions are dependent on another principle of the nervous system; and it is proved by a series of experiments, that this principle is the *vis nervosa* of Haller, acting according to a new reflex law.

3. The phenomena of the excito-motory reflex actions are obvious in cases of paralysis, in proportion as that paralysis is more complete; they are therefore, more observable in paraplegia, than in hemiplegia, in general, but in each of these according to their intensity; they are therefore not only independent of sensation and volition, but inversely as these, frequently disappearing as these return.

4. In accidents, as in experiments, the excited reflex actions are not immediately observed, but are manifested only after the lapse of certain intervals of time; it is plain therefore, that the first influence of shock, is to diminish the excito-motory power; and this may remain until the patient falls a prey to

the accident; as in the case noticed in Dr. W. Budd's paper.*

5. It is observed that at a subsequent period, in more favourable cases, the excito-motory power is not only restored to its normal condition, but morbidly augmented.

6. This is especially observed in certain diseases, as tetanus, the effects of strychnine, &c.

7. The reflex arcs of the nervous system will be imperfect in cases of disease or injury of the lumbar or other regions, as in the case noticed in Dr. W. Budd's paper,† and the reflex actions will consequently be absent; a fact which affords, in its turn, an important source of diagnosis, as to the seat of the disease.

8. In certain cerebral affections attended by coma, the presence or absence of reflex actions, in the eyelids especially, gives us an index of the degree of severity of the disease.

9. Certain diseases, as hydrophobia, epilepsy, hysteria, and certain remedies, as strychnine, cantharides, &c., not only induce augmented excitability, but manifest their effects precisely upon the organs which are, physiologically, under the influence and dominion of the excito-motory power.

10. There are new forms of disease of the true spinal functions, not hitherto described, such as the dysphagia, the peculiar action of the rectum, &c., which have been briefly noticed.

* Medico-Chirurgical Transactions, vol. xxii, p. 185.

† Ibid.

11. Certain parts, as the sides of the thorax, the soles of the feet, &c., are more susceptible of the excitement in question than others.

12. Dr. W. Budd has very justly observed, that in many cases of violent reflex, and even convulsive actions, there was no sense of fatigue, and little emaciation of the muscles. In fact, fatigue is a cerebral state, and cannot be expected to occur in the cases in which the reflex actions are most observed; and emaciation is most obvious in spinal paralysis, in which the reflex arcs being interrupted, the reflex actions are also precluded from taking place. Fatigue *is felt* severely after violent attacks of epilepsy and other spasmodic diseases, in which the cerebral functions are afterwards restored.

I beg to observe in conclusion that, lengthy as this communication may appear, I have done my utmost to curtail it, and have omitted much that I should otherwise have inserted. On some future occasion, I trust I may be allowed to explain, more particularly than I could do on this, *the plan of observation of diseases of the nervous system*, to which I have briefly adverted, p. 163. The importance of this view of the subject will be at once apparent on reading the valuable works of M. Lallemand and M. Andral, whose cases, indeed, would require to be observed anew, with a distinct reference to these recent views of the nervous system. Scarcely a case of cerebral or spinal disease occurs in which it is not necessary, at the bed-side, to advert to the

distinctions which I have pointed out, in reference both to the diagnosis and treatment. Such is the *practical* application and value of this investigation.

It is necessary to advert to another important topic—the influence of *emotion* in diseases of the nervous system. This I propose doing in a third memoir.

MEMOIRS

ON SOME

PRINCIPLES OF PATHOLOGY

IN THE

NERVOUS SYSTEM.

By MARSHALL HALL, M.D., F.R.S. L. & E., &c.

READ JUNE 23RD, 1840.

MEMOIR III.

On the distinct Influence of Volition, of Emotion, and of the Vis Nervosa.

In my two former Memoirs I have treated, firstly, of the condition of the muscular *irritability;* and secondly, of the phenomena of the *reflex* and *retrograde* actions of the spinal marrow, in various diseases of the nervous system. In the present Memoir, which may be regarded as completing, for the present, the subject of the morbid actions of the muscular system, I propose to point out some other sources and phenomena of those actions.

There are *three* causes or principles of muscular motion in the animal economy, besides the motor

contractile power in the nervo-muscular fibre itself; viz., *volition*, *emotion*, and the direct and reflex actions of the *vis nervosa*. In order that the subject may be the more distinctly understood, I will, in the very first instance, adduce facts which will illustrate these several modes of action, excepting, however, the reflex, which forms the subject of Memoir II.

1. *Volition* has a constant influence over some of the muscular actions, of which we are almost unconscious, and which we only discover by carefully observing the effects of its subtraction. The acts of respiration, originating, as they do, in the reflex function of the spinal marrow, are nevertheless regulated and rendered equable by this silent but constant influence and agency of volition. Let this influence be withdrawn, as it is greatly during sleep, and in the moments of great attention, and the respiration immediately becomes audible, suspirious, and irregular. I have particularly noticed the condition of the respiration during deep sleep, and during the intense application of the mathematician in his studies, and of the engraver in the execution of the finer parts of his work, and I have uniformly observed the effect of this subtracted influence of volition. In coma the same phenomena are still more remarkable, and the respiration becomes stertorous, variously irregular, and alternately suspended and sighing. The degree of this change marks the degree of the coma; but when the coma is deep, other causes are involved besides the subtraction of volition, viz., an impaired condition of the reflex function itself, arising

from counter pressure on the medulla oblongata, a point which I propose to discuss hereafter.

It is difficult to determine how far this regulating influence of volition is essential to life: the anencephalous human fœtus, in which the true spinal system is perfect, is, nevertheless, *not* viable; yet in the experiments of M. Flourens, the common fowl lived for a considerable period after the removal of the cerebrum.* The effects of opium and other narcotics would doubtless prove fatal in many instances, if the patient were allowed to enjoy his overwhelming sleep and were not constantly roused to continued acts of volition with their attendant influence on the respiration; we keep the narcotized patient moving, that he may be kept breathing. I need scarcely observe that the position of the body, as well as every action of locomotion, involves the constant and the almost equally unconscious influence of volition. As the true rhythm of respiration is sustained by the constant agency of volition, so every act and every step are guided by the same power continually. In cases of anæsthesia, the patient cannot retain a cup between his fingers safely, unless he keep his eye steadily fixed

* "J'enlevai les deux lobes cérébraux à la fois sur une belle et vigoureuse poule.

"Cette poule, privée de ses deux lobes, a vécu dix mois entiers dans la plus parfaite santé, et vivrait sûrement encore, si, au moment de mon retour à Paris, je n'avais été obligé de l'abandonner. *Du Système Nerveux, par P. Flourens*, 1824, *p.* 87.

upon the object and the grasp, so as to supply by vision the loss of the sense of touch, the usual and the essential prompter of the acts of volition.*

2. But if volition has frequently a silent and unsuspected influence on the muscular movements, this is still more true, for obvious reasons, of *emotion*. This assertion will not appear unguarded when I recall to the mind of the members of this Society that the influence of emotion is the almost sole cause of *expression*, whether this be observed in the countenance, the hand, the respiration, or in the action of other parts of the muscular system. Man lives a life of emotion, and every passing thought, every care, desire, passion, is impressed as it were on the muscular system; violent emotions, as sudden and great surprise, induce spasm of the muscles, or the very contrary effect, as seen in the relaxation of the sphincters from fear. The internal organs equally feel the influence of emotion: the heart and some parts of the arterial system, the intestinal

* The course and the flight of birds continue after decapitation and, therefore, independently of volition, and, consequently, of *aim* or design. In such cases, flight depends on the *vis nervosa* on the same principle, therefore, as the respiration. In this manner we explain the circumstances of the long flight of the swallow, &c., in their migration, and the high flight of the lark during its love song: excited by instinct and desire, these flights are *guided* by sense and volition, but they are sustained by a principle which, as in respiration, is incapable of fatigue. Our surprise at the immense flight of these birds is consequently greatly diminished. But this subject must not be pursued on the present occasion.

canal, &c., the cutaneous surface, the kidney, &c., are obviously amongst this number.

Every day's observation convinces me that the effects of emotion, in inducing and complicating diseases of the nervous system, are greater than has hitherto been imagined. This is observed, as I shall presently have occasion to state, more particularly in chorea, tetanus, &c.

In healthy circumstances the influence of emotion is contracted and frequently altogether counteracted by that of volition. But in circumstances in which this latter influence is withdrawn, that of the former becomes strongly manifested. Thus the agitation of Nelson's heroic mind could not have been seen in his countenance or actions, under ordinary circumstances, but the stump of his amputated arm, withdrawn from the habitual subjugation of volition, was violently agitated on many trying occasions of emotion; and I have seen similar effects in other instances. Thus, too, the hemiplegic arm, paralysed to volition, is moved and agitated by every emotion, such as surprise, and especially such as are connected with respiration (and they are only connected with respiration and not really respiratory), as sighing, yawning, stretching, &c.

Not only does emotion remain in connection with the hemiplegic limb when sensation and volition are severed from it, but that emotion exerts its influence precisely upon those muscular organs which are under the influence of the *vis nervosa*, or excito-motory power: viz., the orifices and sphincters,

the agents of ingestion and egestion ; and as the *vis nervosa* acts *directly* upon certain internal organs, as well as *reflectively* upon those just mentioned, we find the heart, the intestinal canal, the organs of secretion, &c., especially under the influence of emotion.

There is a near connection between emotion and hysteria, which is doubtless very much a disease of emotion ; the same organs, the same functions, are affected. Emotion affects the larynx, the pharynx, inducing a feeling of choking or of globus. I have known it induce dyspnœa, vomiting, jaundice, relaxation of the sphincters, palpitation, syncope ; to blanch or flush the cheeks ; to arrest the secretion of the saliva, of the bile, and singularly to augment that of the perspiration and of the urine.

Sensation and volition thus are seated in the cerebrum and its prolongations ; emotion in the true spinal and the ganglionic systems. It is this distinct view of the subject to which I wish to draw the attention of the physiologist and pathologist. It is in such a view that physiology and pathology meet and mutually illustrate each other.

3. Another form of muscular action, if not of emotion, is that seen in the muscular system in general, and designated *tone ;* the effect, I believe, of the constant agency of the *vis nervosa*. Far less obvious during the healthy condition of the system, it is made very manifest in certain circumstances of disease, and on the first cessation of the animal functions in death. When the influences of volition are

withdrawn in hemiplegia, the hand and arm become much and permanently contracted. The influence of the same power is observed immediately after death, in the phenomenon termed cadaveric rigidity.

In tetanus, and in some diseases of the spinal marrow and of the muscular nerves, we observe the effects of the augmented action of the *vis nervosa*.

Let us now examine the effects of hemiplegia: the arm is perfectly paralysed to *volition*, but it is agitated by occasional *emotion*, and it undergoes a gradual tonic spasm or contraction from the constant influence and direct action of the *vis nervosa*: nothing can be more distinct than the separate operation of these three causes or principles of muscular action in this instance.

Let us next consider what occurs in some affections of the true spinal marrow: in one patient a pen could be grasped and held in its proper position for a moment or two by a strong effort of volition, but this was speedily overcome by the more energetic influence of the *vis nervosa*, and the pen could be retained in its proper position no longer. In another case, the hand and arm shook violently, but it could be restrained for a few minutes, and for a few minutes only, by an energetic act of volition.

On the other hand, stammering, and chorea, and the paralysis agitans, and other cognate affections of the true spinal system, are vastly aggravated by emotion: they are, on the contrary, suspended during quiet and undisturbed sleep.

This remark leads me to observe that as in quiet sleep we have the absence of volition and emotion and of their effects, these all return during dreaming, and on awaking. The *first* sleep especially, and the transition from sleeping to waking, are circumstances peculiarly connected with certain diseases of the nervous system, however the fact may be explained: hence the singular frequency of the attacks of the croup-like convulsion in infants late in the evening, and of epilepsy in adults on awaking in the morning.

Are these events connected with dreaming or emotion, or do they arise out of the impaired condition of the inspiration, to which I have already adverted? The singular occurrence of epilepsy from sleep disturbed by external circumstances would lead to the former opinion, whilst that of asthma about midnight, would rather lead to the latter.

To trace these principles of action in their healthy and morbid relations, must be very important. But this task can only be accomplished by long continued observation, and in some cases by numerical deduction.

I now proceed to pass in review, a little more particularly, the various diseases of the nervous system which can illustrate the questions before us.

I. OF THE DISEASES OF THE CEREBRAL SYSTEM.

I first revert to the subject of hemiplegia. Pure and uncomplicated hemiplegia dissects and severs,

as it were, the cerebral from the true spinal system, volition from emotion and the *vis nervosa*. One side is affected, generally the side opposite to that in which the disease of the cerebrum exists, and the face, tongue, arms and leg are variously paralysed to voluntary motion. But the true spinal system is unaffected, the effects of emotion, and of the action of the *vis nervosa*, deglutition and respiration, and the powers of the sphincters, remain unimpaired. There is paralysis, as in cases in which the cerebral system alone is affected, and there is none of the spasmodic affection seen in diseases of the true spinal marrow. The saliva sometimes runs over the lip, the articulation is imperfect, the food collects on one side of the mouth during mastication, the consequences of paralysis from cerebral disease, but, as I have already stated, deglutition is unimpaired, because the spinal system, of which it is a function, is unaffected. The arm is actually more affected than the leg, because the upper extremity is more distinctly devoted to voluntary movements than the lower extremity, which is more an agent of progression, and more under the influence of the excito-motory power.

It is true that in the previous attack of apoplexy the respiration is frequently stertorous, deglutition imperfect, and the power of the sphincters impaired. But these effects are to be connected with the state of apoplexy, and are probably due to counter pressure on the medulla oblongata, and the danger of the case is in proportion to their manifestation and

obstinacy,—a most important general fact in the prognosis. They persist in fatal cases, but they gradually subside in the others, with the state of apoplexy and of danger.

A distinction of great importance has recently been strongly insisted upon by M. Leuret, in his valuable work, "Du Traitement Moral de la Folie," viz., between mania with and without paralysis. Mania without paralysis is, according to M. Leuret, unattended by morbid appearances, detectible hitherto, but the physical changes of structure, and the loss of muscular power, are associated together. Volition is, as in hemiplegia, more or less severed from the muscular system by the organic changes.

It rarely happens that, in other diseases of the cerebrum than hemiplegia, the diseased structure and the symptoms are so distinctly confined to the cerebral system. In apoplexy, the pressure, or rather the counter-pressure, is extended, as I have stated, to the medulla oblongata. The same event is observed in a still more marked manner in ramollissement, as is manifest from the spasmodic action of the muscles; the same event, too, is observed in the progress of effusion into the ventricles, which may frequently be traced by the gradual annihilation of some of the true spinal acts, as those of the eyelids, and the occurrence of spasmodic affections, affections which do not result from disease, the effects of which are restricted to the cerebrum.

But whilst the influence of the disease is limited to the cerebrum, its symptoms must be limited to

morbid effects in the senses, the judgment, the volition,—in a word, to the cerebral functions. In uncomplicated hemiplegia, we have paralysis of voluntary motion: but the influence of emotion, and of the *vis nervosa*, is more obvious even than before. The opposite side of the body is paralysed to volition; frequently the patient is seen bearing his hand and arm in a sling like an inert weight; but let him be agitated, let him yawn or stretch, and the arm is frequently immediately moved with extraordinary energy; examine his hand, and you will frequently find it drawn forcibly to the side, the fingers being forcibly contracted into the palm, communicating, on your attempts to open them, the idea of a steel spring.*

The effect of hemiplegia, as I have said, is to paralyse the power of volition on the opposite side of the body, whilst the influence of emotion on this side remains. The seat, the source of these, must therefore be different. Those of the former are higher in the cerebrum, those of the latter lower down,—below the disease, probably in the medulla oblongata. Volition acts along fibres which decussate and affect the opposite side of the frame; emo-

* In such cases the muscular irritability is, as I have stated in my *first* Memoir, augmented. But in cases of *very* long duration, I have found that on the supervention of great emaciation of the paralytic muscles, the augmented irritability of their fibre, with the effects of emotion, of sudden cold, &c., and of the *vis nervosa*, gradually disappears. See and compare vol. xxii, p. 214.

tion, like inspiration, has probably its course along another set of fibres, which do *not* decussate.

We may conclude, then, that hemiplegia severs the different motor powers from each other, and demonstrates their individual and separate existence: the influence of volition is cut off; that of emotion is occasionally, that of the *vis nervosa* constantly, energetic. Paralysis in regard to volition; agitation on occasions of emotion; tonic contraction from the constant action of the *vis nervosa*; such are the facts presented to our observation and consideration. The last of these is portrayed in fig. 1 of the wood-cut in the next page.

For cases illustrative of these phenomena of hemiplegia, I may refer to my former Memoirs.*

II. OF THE DISEASES OF THE TRUE SPINAL SYSTEM.

Tetanus may be taken as the purest example of disease of the true spinal system. Whilst it spares the cerebrum, and with it the intellectual functions, it affects all those organs and actions of ingestion and of egestion, and, in a word, of the excito-motory system, which, as I have stated, are spared by hemiplegia. Deglutition, respiration, defæcation, are variously impeded.

The intellect is serene. The excito-motory power is, on the contrary, augmented; the excito-motory

* See vol. xxii, pp. 207, 210, 211; and the preceding Memoir in this volume.

actions morbidly violent. Every kind of emotion, every external stimulus, acts with tenfold violence.

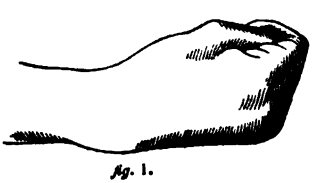


fig. 1.

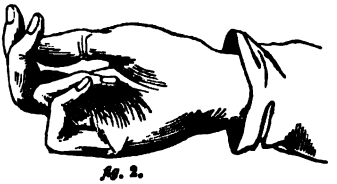


fig. 2.

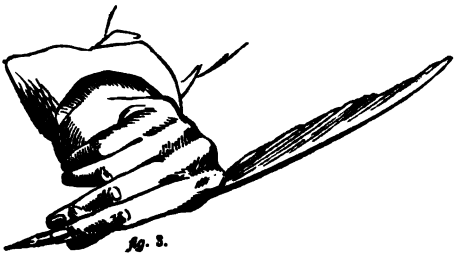


fig. 3.

fig. 4.

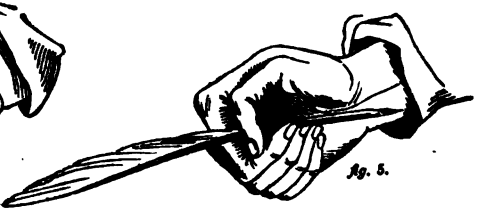


fig. 5.

fig. 6.

fig. 7.

Any sudden or startling noise, as the cannon, the drum,—any external impression, as a sudden jar,

the contact of the cold air, &c., are attended by the most painful and agonizing exasperation of the symptoms. Such, indeed, is the baneful influence of these various excitements, that I am persuaded that the very same treatment of tetanus may be successful or unsuccessful, according as we carefully avoid, or admit, the influence of emotion and external stimuli. Bearing this fact in our mind, the patient should be kept as free as possible from the intrusion of visitors, and should be carefully surrounded by an atmosphere of uniformly elevated temperature charged with moisture, every draught of wind and all exposure of the cutaneous surface being cautiously avoided. We all remember the case in which the sudden plunge into a cold bath proved fatal. Other but less severe agencies of the same kind may prove injurious, though in a less terrible degree. Stillness, and even darkness, are essential to the safety of the patient.

I must once more advert to the influence of emotion in diseases of the nervous system. It is well known that the irregular movements in chorea and in incipient paralysis agitans, subside during sleep. I was long perplexed to account for this fact. It was only by observing that these movements subside during *quiet* sleep only, and return during the agitation of dreaming, that I perceived that it is not sleep, but the absence of emotion, to which this effect is to be ascribed. Dreams during sleep have the same effect as emotion in our waking hours. In

regard to stammering, I believe it would scarcely exist without emotion; it is certainly exasperated in a tenfold degree by every cause of emotion, and is mitigated precisely in proportion to the mental quiet, composure, and self-possession of the patients,—facts which point to a principle of the utmost moment in the treatment of this disease. The true idea of stammering is, in fact, that of certain voluntary acts impeded and modified by emotion.

But to return to the subject of tetanus. Traumatic tetanus being a series of morbid reflex actions, affords the type of affections of the system of incident and reflex nerves, and of their combiner, the true spinal marrow. The morbid influence is also retrograde as well as reflex. In disease originating in the spinal centre, the effect is usually less general, because retrograde; but it is not less marked because more limited.

Still more limited, in its effects, is disease seated in the reflex or muscular nerves. Such disease is seen in the cases of spasmodic tic and torticollis. Spasmodic tic frequently arises from the influence of exposure to cold: the first effect is generally paralysis; the second, tonic or clonic spasm,—a fact not hitherto observed, and owing, I suppose, to the particular condition of the nervous texture, at the earlier and later periods of the disease. This particular subject I propose to discuss more at length at some future period.

I will now close the subject of the sources of

muscular action in diseases of the nervous system, by a few brief sketches, in which the different effects of volition and of the *vis nervosa* are distinctly seen.

CASE I.

In a youth aged about twenty, whom I visited after an attack, in which the speech became inarticulate and the left arm affected with continual rapid spasmodic movements, the limb could be kept perfectly still for several minutes by a continual energetic act of volition.

In this case, the influence of volition antagonized and controuled that of the *vis nervosa*. In the following case this interference was, if possible, still more marked:

CASE II.

This patient's case has been already noticed in this Memoir (p. 174). The patient can hold and retain his pen in a proper position, as long as his attention is kept up to perform a constant and energetic act of volition; the moment the attention and the consequent act of volition are relaxed, the pen assumes the several positions beautifully portrayed in the sketches made by an eminent artist, (p. 180, figs. 3, 4, 5,) in consequence of involuntary movements, the result of morbid acts of the *vis nervosa*.

A similar effect from energetic voluntary effort is seen in chorea, and, as has been stated, in stammering. The patient can guide his hand and his leg, whilst volition is more energetic than the *vis nervosa*. The disorderly movements from the morbid activity of the latter, return when volition is less energetic. This fact may be illustrated by the following interesting extract from the elegant work of Heberden:—"Puero cuidam cum crura vehementer agitabantur, motus involuntarii superabant omnes movendi conatus leniores; membris autem fortius impulsis morbus superabatur: ergo currere potuit, qui non potuit ambulare." *

CASE III.

The next case is one in which the third finger was rather rigidly and permanently contracted by the influence of the *vis nervosa*. It was very little under the control of volition. It is sketched in fig. 2, p. 180. The patient recovered under the influence of issues and mercury.

CASE IV.

The following case I owe to the kindness of the late Mr. Brugen of Banbury:—

"The patient, a brazier by trade, and about forty-five years of age, had spinal angular curva-

* Commentarii, &c., ed. 1807, cap. xx, p. 93.

ture, extending through several of the dorsal vertebræ. The peculiar feature of the irritation of the chord, in addition to the usual symptoms of more or less paralysis of the sentient nerves, was great and incessant spasms and contractions of the muscles; chiefly of the flexors of the lower extremities, and also of those contracting the passage of the alvine and urinary secretions. Sometimes the urine would be forcibly ejected, and at another time the introduction of the catheter was exceedingly difficult. The irritation of the motor tract was so severe in its effects on the muscles of the thighs, that the heels were pressed so strongly against the buttocks, as, one time, to create ulceration. After death, a *rough* nodule of bone, like an exostosis, was found to project from the body of one of the vertebræ, about the middle of the curvature, to the extent of half an inch into the canal of the spine, and, no doubt, was the cause of the severe marks of inflammation and disorganization which the chord and its coverings at that point presented, and occasioned the symptoms in question."

CASE V.

I must next notice the case of an infant some months old, in which the crowing inspiration distinctly occurred once or twice, with the spasmodic affection of the hand portrayed by figs. 6 and 7, and a state of opisthotonus; several times there was such impaired deglutition as to threaten suffocation,

on merely giving a tea-spoonful of water. The following is an account of the post mortem appearances:—There was slight effusion into the ventricles, and more considerable effusion under the arachnoïd at the base of the brain; and the medulla oblongata was very, I think morbidly, consistent. Besides these, there were *no* morbid appearances—no granulations in the arachnoïd, no tubercles in the lungs, no disease of the mesenteric glands.

A similar state of contraction of the hand, and of the toes, from teething, &c., is by no means unfrequent.

III. CONCLUSION.

It may be inferred, I think, from the preceding cases and observations, compared with experiments,* and the recorded facts in regard to hemiplegia,† that the seat of volition is the cerebrum, and that its action is along the fibres which *decussate* in the medulla oblongata, and that the seat of emotion is below that of volition, and that it acts along fibres which probably do *not* decussate. In these respects the effects of emotion resemble those of respiration, as seen in yawning, and this function is known to act in a direct manner, from the medulla

* Flourens du Système Nerveux.

† Dr. M. Hall's Memoirs in this and preceding volume.

oblongata not decussating. The same remark, and for the same reasons, may be made in regard to the tonic action of the *vis nervosa*.

Volition has an object, an aim. Emotion, and the *vis nervosa*, however subdued to certain laws impressed by the Creator, and destined to special purposes, are aimless on the part of the individual, nay, frequently *opposed* to his volition, as in Case II.

According to the views of M. Flourens, and according to the emphatic expression of Professor Müller, volition acts upon the fibres of the medulla oblongata, as the finger upon the keys of a harpsichord. So do emotion and the *vis nervosa*. Where then is the difference of the effect produced? These agents act upon different instruments!—Volition along the intra-vertebral *chord* of cerebral *nerves*; emotion, and the *vis nervosa*, upon the fibres of the *true* spinal *marrow*.

In Case II, the functions of the spinal marrow were disordered. No force of the finger can produce harmony from an instrument out of tune. If volition had acted through the deranged organ, the result would have been a disordered act, instead of the regular action observed. It was the *vis nervosa* which, acting upon the deranged organ, induced morbid actions. This fact, this case alone, appears to me sufficient to establish the distinction between the chord of cerebral nerves and the true spinal marrow.

The same conclusions must be drawn from the

facts observed in the paralysis agitans, and chorea. Opposed to volition, augmented by emotion, the movements observed in these diseases depend upon the *vis nervosa*, the motor power of the true spinal marrow, directly, or according to a reflex operation, and augmented by emotion.

POSTSCRIPT TO MEMOIR I.

In this postscript I wish to notice very briefly a point of interest in regard to the present inquiry. It is

The Influence of Shock.

In Dr. W. Philip's experiments it was found, that although the brain and spinal marrow might be gently removed, without immediately affecting the action of the heart, yet that neither of these organs could be *crushed* without immediately diminishing that action.

In one case of hemiplegia I found the muscles of the paralytic limbs less irritable soon after the attack, than those of the healthy side; afterwards they became more irritable, according to the general law laid down in my first Memoir.*

It has been observed, both in experiment and in disease, that the reflex actions are not manifested

* See Medico-Chirurgical Transactions, vol. xxii.

immediately after an injury of the spinal marrow, but that they become gradually established more remotely.*

In a series of experiments performed upon the connexion of the nervous system with the circulation, I found that, after the total removal of the brain and spinal marrow in frogs, the capillary circulation continued in the web during thirty-six hours; but that it was instantly arrested by crushing the other limb.† This effect could only be produced through the ganglionic system.

In Dr. J. Reid's experiments the same effect was produced by repeatedly galvanizing the muscle.

The effects of a violent accident upon the human frame are well known, and must be explained upon similar principles,—principles not yet fully understood.

Lastly, a blow upon the tibia induces a temporary paralysis of the muscles of the leg.

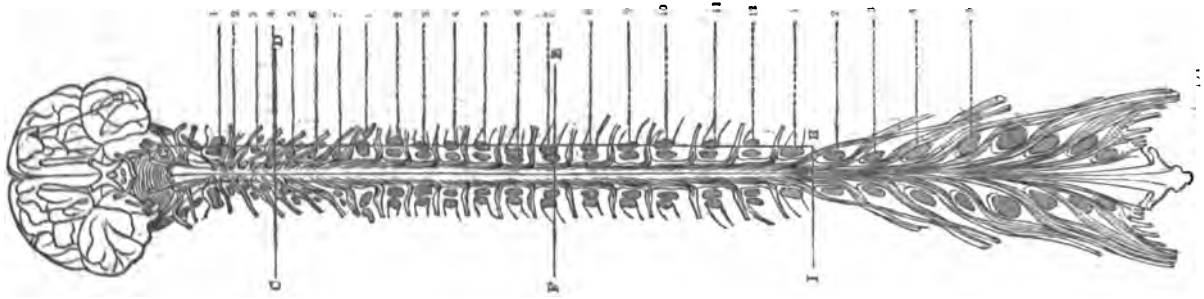
I have thus treated of the different sources of muscular motion, volition, emotion, the direct and reflex influences of the *vis nervosa*, the irritability of the muscular fibre. The relation of all these to the different causes of paralysis is shown in the annexed wood-cut, which I wish once more to reproduce here.

* See Dr. W. Budd's Paper in Med.-Chir. Trans., vol. xxii.

† Essay on the Circulation, 1831.

Lines of Cerebral and Spinal Paralysis.

A B—Paralysis of the Cerebrum, excluding sensation and voluntary motion: the effects of emotion, and the reflex and direct actions of the *vis nervosa*, with augmented muscular irritability, remaining.



C D—Paralysis of the Cerebrum and Medulla oblongata, excluding sensation, voluntary motion, and the effects of emotion; the reflex actions, and the irritability remaining.

G H, H I—Paralysis of the Spinal Marrow, excluding sensation and voluntary motion, the effects of emotion, and the reflex actions; the muscular irritability being lost or impaired.

Early in the next Session, I propose to lay before the Society a Memoir, which I have been long preparing, " On the *Plan of Observation* on Diseases of the Nervous System."

ON THE PRESENCE OF

SULPHUR IN CYSTIC OXYDE,

AND

AN ACCOUNT OF A

CYSTIC OXYDE CALCULUS.

(IN THE MUSEUM OF UNIVERSITY COLLEGE, LONDON.)

By HENRY BENCE JONES, B.A.,

OF TRINITY COLLEGE, CAMBRIDGE.

Communicated by CHARLES HAWKINS, Esq.

READ FEBRUARY 25TH, 1840.

The discovery of the existence of sulphur in cystic oxyde, by M. Baudrimont, in France, with the confirmation of this observation, by M. Thaulow, in Germany, seems to have satisfied chemists abroad of the constancy of that element in this species of calculus. But the well-known accuracy of Dr. Prout, and the apparent impossibility of overlooking the large quantity of sulphur (above 25 per cent.) which these foreign chemists have found, must still cause us at home to hesitate, and at least to suggest, that possibly there may be two similar cystic oxyde calculi, which differ, in the one having more or less of its oxygen replaced by sulphur. Instances are not wanting in which this element is substituted for a part or even the whole of the oxygen

of an organic principle. Thus Dumas and Pelonze have shown that the volatile oil of mustard consists of C_{32} H_{20} N_4 S_5 O_5 while in the oil of cloves O_{10} is found, and no sulphur. (Annales de Chimie, &c., t. 53.)

An instance of the total substitution of sulphur for oxygen is supplied by mercaptan, which consists of C_4 H_6 S_2 while alcohol is C_4 H_6 O_2.

Supposing that two compounds so related exist, the names of cystic, and sulphocystic oxydes would, perhaps, best distinguish them.

In opposition, however, to this supposition, we must mention that Pelonze, whose first analysis had agreed with that of Dr. Prout, re-examined the subject after the discovery above-mentioned, and in a communication to Professor Graham, stated that he then found sulphur present.

The analysis by M. Thaulow is contained in the twenty-seventh volume of the Annalen der Pharmacie, and is placed in comparison with that of Dr. Prout and Pelonze, as follows :—

	Thaulow.		Prout & Pelonze.	
	Reckoned.	Found.	Reckoned.	Found.
Nitrogen . .	11·7	11·	11·85	11·67
Carbon . . .	30·31	30·01	29·875	30·
Hydrogen . .	4·94	5·1	5·125	5·
Oxygen . . .	26·47	28·38	53·15	53·33
Sulphur . . .	26·58	25·51		

whence is deduced the formula C_6 N H_6 O_4 S_2= cystic oxyde: in which the constancy of the sulphur is assumed, though this can only be determined

by the examination of many calculi, and will, for some time, be the object of greatest interest in the analysis of this species.

Such, at least, appeared to me to be the case, when I identified as a cystic oxyde calculus in the collection of calculi belonging to University College, London, the largest specimen probably of this species which exists. It has the form of a large flattened egg, and has been divided. The greatest diameter is two and a quarter inches; the smaller, one and three quarters. The two halves together, after the loss from sawing, grinding, testing, &c., weigh above 850 grains.

Nothing is known of the history of this specimen of the cystic calculus. The external surface is much broken away; the highly crystalline structure of this portion usually seen is lost, and what now remains of the outermost layer has a dirty yellowish colour with a waxy lustre, and is, externally, not unlike some biliary calculi.

The surface of the unpolished section is of a yellowish white colour, and in all parts, when closely examined, had a glistening look from minute crystals, which are best seen by candlelight. In the centre there is a small nucleus, around which are two concentric rings, and then for more than a quarter of an inch no more are seen, but in this space the structure appears less compact (having small portions broken away) than that of the more external portion, which last consists of numerous concentric layers, (above forty,) alternately of a whitish yellow and of a darker colour.

There is no radiation from the centre and no green appearance, which Dr. Marcet thought characterized the larger specimens of this species. When burned, the calculus left a small white ash, and though it in some trials appeared that the central part gave less ash than the more external layers, yet this was not always the case, and in no part was the ash entirely wanting. This ash, on examination, was found to be phosphate of lime.

A portion of the calculus powdered was soluble with effervescence in nitric acid, and gave, when evaporated to dryness, a brownish-black residue, not altered in colour on the addition of ammonia or potash.

Hydrochloric acid dissolved the calculus without effervescence, and the solution, when quickly evaporated, gave a most disagreeable odour. The crystals formed by slow evaporation of the solution were prismatic.

It was soluble in alkalies and their carbonates, even in the carbonate of ammonia; probably from its containing free ammonia.

The crystals from the solution in ammonia were usually short six-sided prisms or rather tables, but sometimes these were mixed with four-sided ones occurring in clusters.

The mode recommended by Liebig for obtaining pure cystic oxyde was followed in examining the calculus with regard to the presence of sulphur. Of ten grains of the calculus, treated with ammonia, about nine grains were dissolved; which is the pro-

portion of cystic oxyde; the remainder being animal matter and phosphate of lime. On the spontaneous evaporation of the ammoniacal solution, crystals were formed, of which five grains were treated with nitric acid free from sulphuric; violent action ensued, after the cessation of which, some crystals of pure nitrate of potash were dropped into the solution, and the whole, after being evaporated to dryness, was gently ignited in a platinum crucible. The white fused mass resulting was alkaline to test paper, and its solution neutralized with nitric acid, gave on the addition of nitrate of baryta an abundant white precipitate, insoluble in the last-named acid. This precipitate, collected on a filter, washed, dried, and ignited, weighed 6·94 grains; corresponding to ·9576 of sulphur, or above 19 per cent. This is considerably less than the amount given by M. Thaulow, but from the smallness of the quantity operated upon, from its having been examined as crystallized from an ammoniacal solution, and from other sources of error, the result must by no means be considered as throwing any doubt on the correctness of Thaulow's analysis, while it confirms the existence of a large quantity of sulphur in cystic oxyde. Whether the sulphur be variable in quantity, or be sometimes altogether wanting, future observation alone can determine. Meanwhile, it may be remarked that the proximate composition of this substance remains inexplicable. We can find no trace of the sulphocyanogen compounds here; it bears scarcely any relation to the substances pro-

duced by the action of sulphurous acid on some of the uric acid compounds; as, for instance, to thionuric acid $C_8 N_3 H_7 O_{14} S_2$ except that it contains the same elements. Nor does it rank in the amidogen class. It is at present an isolated compound, and offers peculiar interest from its character as a compound base possessing a high atomic weight, from which a long series of compounds may at some future time be derived. It is this peculiarity of composition, and not the mere presence of the sulphur, which renders cystic oxyde so remarkable; for as Dr. Prout observes, in his Bridgewater Treatise, p. 122, "Not only does sulphur exist in large quantities in the mineral kingdom, but in a greater or less proportion in almost all animal and many vegetable products." Hence the certainty of its introduction into the human system. Accordingly, sulphur in the form of sulphate is found in the blood, bile, and urine, and probably as a sulphuret also in the last. In the hair and brain it exists as a sulphuret, whilst hydrosulphocyanic acid is found in the saliva, and sulphuretted hydrogen in the intestines.

There are a few points respecting the cystic oxyde calculus established by this specimen which deserve notice.

Firstly, The occasional occurrence of concentric rings, and the absence of all radiated structure and green colour. A small cystic oxyde calculus in the possession of Professor Everitt agrees with the above in these points.

Secondly, The occasional large size of this species of calculus,

Thirdly, The presence of varying quantities of earthy matter in all parts of the calculus, thus rendering it a compound one.

A beautiful and also very large specimen in St. Bartholomew's Hospital is said to contain small quantities of phosphate of lime and phosphate of ammonia and magnesia. The calculus analysed by M. Thaulow also contained a minute quantity of phosphate of lime.

In conclusion, I have to return my thanks to Professor Graham, in whose laboratory I examined this calculus, and to his assistant, Mr. Fownes, for their kindness, and for the advice which they have given me.

CASE

OF

LARGE OSSEOUS TUMOUR

OF

THE UTERUS.

By JAMES M. ARNOTT, Esq.,

SURGEON TO THE MIDDLESEX HOSPITAL.

READ MARCH 7TH, 1840.

I SUBMIT to the inspection of the members of the Society an unusually large osseous tumour of the uterus, weighing five pounds; which occasioned no inconvenience during life, but which contributed to the death of the patient in a somewhat singular manner.

A maiden lady, aged 72, was run against by a large dog, and fell forwards on the pavement in Regent Street, the 18th of February, 1840. She felt severe pain in the belly, but was able to walk some distance. When I saw her, five hours after the accident, with Mr. Vickers, who was in attendance, she complained of most intense pain in the abdomen, which presented no external mark of injury, but was tense, extremely tender to the touch, and promi-

nent, in consequence of a hard tumour occupying its lower part. There was a pallid, anxious, and even an alarmed, expression of countenance. The skin was warm, the pulse nearly natural in its character. There had been neither sickness nor vomiting. The contents of the bladder were evacuated without difficulty, but with increased abdominal pain. Some severe internal injury was dreaded: leeches, with fomentations, were repeatedly applied, —opiates exhibited,—perfect rest and strict diet enjoined,—but the patient died in thirty-four hours.

The post mortem examination was made in the presence of Dr. Elliotson and Mr. Vickers.

On turning back the skin of the abdomen, a bruise with ecchymosis was found in the left rectus abdominis muscle. There was general and intense inflammation of the peritoneum, into the cavity of which fæculent matter had escaped On searching for the origin of this, it was found to proceed from a small circular aperture in the ileum towards its lower part; the coats of the bowel at the spot, and the adjoining portion of mesentery, being ecchymosed.

The injured intestine formed part of a coil which lay in front of the convex surface of the tumour, already mentioned as having been felt through the abdominal parietes during life. This, as I have stated, was hard, in fact osseous, and of the size of the uterus in the fifth month of pregnancy; it likewise resembled it in shape; rising, too, out of the pelvis into the abdomen, and covered with perito-

neum. The rupture of the intestine, which was in front of this, corresponded in situation with the bruise of the rectus muscle; and both had evidently resulted from the violence to which they had been subjected by the fall; having been compressed between the convex osseous tumour *behind*, and the pavement in *front*.

On removing the tumour, which was effected with some difficulty, so firmly was it impacted in the upper opening and cavity of the pelvis, the bladder was found attached to it in front, low down; but the uterus could not be readily made out. However, on tracing the vagina upwards, the cavity of the uterus was discovered in the shape of an elongated, very narrow canal, stretching along the posterior surface of the tumour, over which the Fallopian tubes were likewise spread out. The *form* of the uterus had *entirely*, and its *substance* in a great measure, dissappeared; for while its posterior parietes, forming the back part of the elongated canal, were reduced to a state of extreme atrophy, so as to resemble membrane, the *anterior* had become expanded and stretched over the surface of the tumour, which had clearly been originally developed in its substance, and was now covered throughout by a very thin, but more or less distinct, layer of uterine tissue.

The tumour was of an irregular oval shape, being larger at the upper end. It measured *seven* inches in length, *nineteen* in circumference in the direction of the oval, *fourteen* round at the distance

of an inch from its upper end, *thirteen* at the same distance from its lower. The colour was yellowish white: the surface slightly tuberculated or botryoidal. It weighed, as has been already stated, five pounds. On being sawn through, it was found as hard as marble, and quite solid: yet the section presented an appearance as if the mass had been formed of several separate portions firmly agglomerated; an *appearance* arising, however, from minute traces of fibrous tissue being here and there still perceptible in it. Attached to the upper extremity of the large one, but distinct from it, there were several small tumours, varying in size from that of a pea to a chestnut, and which presented precisely the same structure.

Professor Daniell, who kindly undertook to analyse the tumour, has furnished me with the following statement of its composition.

Animal matter, including water and ammoniacal salts	35·
Phosphate of lime, with a small quantity of phosphate of magnesia . . .	56·
Carbonate of lime	5·
Alkaline sulphates, phosphates, and muriates	4·
	100·

When, on my first visit, I directed the patient's attention to this tumour, she attached no import-

ance to it, and remarked that it had been long there, and occasioned no inconvenience. Indeed, this had been so completely the case, that some of her nearest relations, who had been constantly in the habit of residing with her during the last thirty years, were not aware of its existence. One of them living with her at the time of the accident, thus expressed herself: "She was of unfailing activity,—took long walks, and was the foremost in any exertion, such as required much standing or stooping. Until the last ten years she rode on horseback."

On application, however, to the lady's sister, the following information was elicited:—

"It was in the autumn of 1808, or the spring of the ensuing year, that, in consequence of Miss —— having mentioned to Mr. —— that she felt something at the bottom of her stomach, resembling in size a goose's egg, and from my not feeling, or rather my *wishing not* to feel, implicit confidence in the opinion which he subsequently communicated to me, of its being of a cancerous nature, and likely to produce consequences which might make her friends pray for her release, that I prevailed on Miss ——— to see Dr. Denman, whom she had often met at my house, and knew intimately. I accompanied her to Dr. Denman's; she submitted to an examination, and he prevailed on her to let Mr. Croft, who was in the house, make the same. They subsequently gave her some trifling directions, speaking cheerfully to her, and I entertained hopes from this circumstance that they had formed a different

opinion to Mr. ——, but they took an opportunity of stating to me that they considered there was cancer of the womb, and quite as much in the inside as the outside; but that it was in an inactive state, and that the less she thought or said about it the better; and from that time to this, the subject has never been mentioned between us, though I could not but perceive the gradual increase of her size."

ON THE RAPID

ORGANIZATION OF LYMPH

IN

CACHEXIA.

By JOHN DALRYMPLE, Esq.,

ASSISTANT SURGEON TO THE OPHTHALMIC INFIRMARY, MOORFIELDS.

READ MARCH 10TH, 1840.

It is of high importance, in a physiological as well as practical point of view, to ascertain whether effusions of the organizable materials of the blood become vitalized by the production of new vessels and channels of circulation, more readily and sooner in cachetic than robust states of the constitution.

At first sight, it would appear probable that the feebler the power of the system, or, in other words, the weaker the force of the systemic circulation, the less quickly would living vessels become interspersed through the effused and solidified materials of the blood. Thus it is true that certain forms of what is always admitted to be inflammation, as puerperal peritonitis, will show fibrine and albumen mingled with serum and floating in flakes, in the cavity of

the serous membrane, from which they have been poured out; and further, such matters, it is believed, are incapable of becoming organized with living vessels. In that disease, however, especially where the patient has survived the first collapse, the intestines have often been found glued together by a plastic effusion, which, by its very adherence to the part whence it proceeds, argues in favour of its vitality, although I am not aware of any attempt at its injection having been yet made. Still no argument can be adduced against the organization of fibrine in cachetic subjects, or in those in whom the powers of life are remarkably low, because of the frequency of the loose floating flakes in the peritoneal cavities of puerperal subjects; since it is to be remembered, that a death-like collapse often ushers in the attack, from which the patient never sufficiently recovers to afford time for further change. There are, however, several facts which lead me to presume, that abnormal effusions from the capillary vessels, without direct rupture of their coats, are more speedily and completely organized with vessels capable of being permeated by our minute injections, in those feeble and depressed conditions of the system, which we denominate cachetic, than in the more vigorous and plethoric, where inflammations are more acute in the outset, and pass through more speedy and determined stages.

In acute inflammations, if the effusion be of blood properly so called, it probably occurs by rupture of the parietes of the vessels, and seldom, if ever, be-

comes organized; at least, we have no proof of the fact, while we have divers proofs that it often becomes speedily absorbed.

Again, serous effusions, from their very nature, are never converted into solid bodies, and they appear rather to relieve local congestions, by diminishing the real bulk of the fluids circulating in the over-distended vessels. Nevertheless, we find direct exudations of fibrine in acute inflammations, in otherwise healthy and plethoric subjects, that undeniably become connected into organized membranes and new structures, unless promptly relieved by art.

These latter are the cases which should be placed side by side with those occurring in feeble conditions of the body, in order to enable us to judge of the question at issue.

Those who have been accustomed to witness ophthalmic diseases on a large scale, cannot fail to be at once struck with the greater tendency to the effusion and organization of fibrine on the surface of the iris in syphilitic cases than in those of idiopathic iritis, and there will be no difficulty in admitting that the specific cases occur, at least in this metropolis, in by far the greater proportion, in enfeebled constitutions;—in those debilitated by excesses, irregularity of moral habits, or the mal-administration of mercury in the primary disease.

The first appearance of the tubercles of fibrine, which is the form such deposits generally assume, is observed at the annulus minor of the iris, where the capillary vessels are most numerously interlaced,

more minute, and constitute the extreme circulation of the part. Gradually, however, as the affection extends, we find these deposits occupying various spots of the anterior plane of the membrane, while from a yellowish colour they assume a red hue, more or less distinctly marked, manifesting the organization of the fibrine. I repeat that this state is more frequently and more decisively seen in the enfeebled than in the robust, although in the latter the other external symptoms appear to run a much higher and more aggravated course.

The most marked case I ever witnessed was in the person of a steward of a ship trading to the East Indies. This man contracted syphilis at Calcutta, and for the cure of the primary sores underwent a most severe and Indian course of mercury; during which he had to work at his usual duties through a very long and stormy passage home. As might have been expected, this person reached England in a miserably weak and shattered state, and about a fortnight after he landed became the subject of iritis.

At the time I saw him (a week after the attack), there were not less than eight or ten tubercles of fibrine, varying in size, the largest about twice the magnitude of a hempseed. Some were of a pale yellow, as if recently effused, some of a bright scarlet, and others again evidently commencing to suppurate. With all this the surrounding sclerotitis and vascular ring were not very remarkable

The patient was placed upon an animal diet, sar-

saparilla, and minute alterative doses of quicksilver and chalk. He rapidly recovered tone; and at the end of about sixteen days every vestige of tubercle had disappeared, although the pupil remained nearly closed by organized adhesions.

I have never observed, in any case of iritis, however severe, in an otherwise healthy person, so rapid a progress to the effusion and organization of fibrine, nor so rapid a recovery, though treated by what was anything but the antiphlogistic plan.

Again; in those affections of the posterior part of the eye in children, which we have been accustomed to call malignant, almost every one has been surprised to observe, in the early stage, how healthy appear to be the subjects of this frightful malady. During the period of the existence of the bright and metallic reflexion from the deposit at the posterior part of the globe, the child appears to retain its ordinary health, although perhaps the disease may be going on to increase. But so soon as you begin to trace the organization of the fibrine, indicated by the red points, or ramifications of actual vessels, not only may you expect a great deterioration of the general health, but also the rapid progress of the affection.

It is then curious to inquire whether the decline of health precedes, accompanies, or follows this organization, or rather, whether it is the cause or consequence. I do not hesitate to declare my belief, that it is the cause rather than the effect; first, be-

cause I have often seen the disease existing many months prior to the organization of the deposit, and upon an accidental impairment of health it has suddenly assumed an active form, and gone on unchecked to a fatal termination; and secondly, because, when in a particular case, the health of the child had by great care been much improved, the disease itself appeared to have been checked, and the globe began to waste; and lastly, because in this same case, when the negligence of the parents again allowed the health of the child to decline, the disease burst forth with redoubled activity, and went on rapidly to a fatal termination. This case, which during the more satisfactory part of its course, was under the care of my friend, Mr. Tyrrell, occupied a space of several months, affording a good opportunity of watching the various phases of the local malady, as compared with the general health of the subject.

Turning, however, to those ravages of disease which only *post mortem* observations, or the result of surgical operations afford us, we shall, I think, equally find, and where we least *a priori* expect, the same ready organization of the materials of the blood, in enfeebled conditions of the system.

A preparation which I wish to bring before the notice of the Society, is an abscess taken from a limb amputated by my friend, Mr. Liston, and beautifully injected by him. The case was one of long continued disease, with ulceration of cartilages, &c. of the knee-joint; and it will readily be granted

that where such extensive mischief existed in so large a joint as the knee, and where hectic fever had already supervened, no vigour, local or general, could be manifested in that patient's constitution.

I need not describe the appearances of the joint itself, for it is to the abscesses alone, in the cellular tissue and amongst the ligaments of the knee, that I beg to refer. These particular cysts were of various sizes; all, however, more or less small, some containing pus, others a cheesy and almost concrete material. All the cavities, however, were lined with what at first appeared to be unorganized fibrine, varying from half a line to two lines in thickness, seldom smooth, but rather rugous, and on its free surface somewhat nodulated or granular. This fibrine was detached with so much facility from the vascular membrane lining the abscesses, as to lead one to conclude it was of recent orign, and had no vascular communications with the highly injected membrane, from which it was evident it had been poured out. When, however, some portions of this fibrine had been carefully removed, dried on plates of glass, and submitted to the microscope, it immediately became evident that it was not only organized, but minutely traversed with vessels, injected, *ex votis*, with coloured size.

When a portion of fibrine had been removed in adhesion with the vascular, or what is often called the pyogenic membrane, the continuity of the vessels from the latter into it was delicately exhibited.

If a portion of both was cut in profile, or if the fibrine was carefully reversed from the surface of the pyogenic membrane, the same appearances were exhibited. Again, when a portion of the fibrine adhering to the vascular web of the abscess was viewed from its free surface, the penetrating power of the instrument showed these delicate capillaries shooting up from below and ramifying to the surface of the effusion.

A case of scurvy under the care of Mr. Busk of the Dreadnought hospital-ship, presented a still more curious evidence of recent organization of the materials of the blood or of the blood itself.

A seaman was received on board the Dreadnought in the last stage of sea scurvy, of which he shortly died. One of the legs of this man was injected, and on examination it was found that a large deposit of coagulated blood adhered to the bone of the tibia, covered by periosteum, which was raised and separated from the bone from the tuberosity nearly to the ancle. On each of the three sides of the tibia was the same appearance observed. The clots measured from three to four inches in length, and in thickness from a quarter to half an inch. The periosteum which firmly adhered to the blood, was divided and reflected above and below, so as to expose the external surface of the clot. The injection had surprisingly succeeded, and the dark coagula were seen, even with the naked eye, studded in every part with red points, as of the torn mouths of vessels that had entered from the periosteum.

Sections of this blood, made perpendicularly to the bone, exposed numerous branches all filled with coloured size, and which appeared at first sight as if they were the vessels that had originally passed directly from the periosteum to the outer lamella of the tibia, but raised and elongated by the separation of the membrane, and traversing the surrounding effused coagula. See Plate II. fig. 1.

When, however, thin slips of this mass were dried on plates of glass, and rendered transparent by immersion in Canada balsam, a most intricate arrangement of capillary vessels was seen, ramifying and inosculating under various angles, and in a somewhat arborescent form, throughout the entire mass of the clot. See Plate II. fig. 2.

Thus, although the larger vessels might possibly have been the original vessels of transmission from the periosteum to the bone, yet it was evident that the whole clot was minutely organized with innumerable new and minute vessels; whose arrangement was so determinate and uniform, as to leave no doubt of the entire dissimilarity of the organization of this tissue from the periosteum on the one hand and the bone on the other.

What the date of the first effusion of the blood, in this case, might have been, does not clearly appear; but it is nearly certain that it could not have been of long standing, since the coagula retained entirely the hæmatosine or colouring matter of the fluid.

Those who have seen one inveterate case of scurvy

well know the absolute prostration of the vital energies; that it not unfrequently happens that a mere change from the horizontal to the erect, or semi-erect position, produces a sudden syncope from which the patient never recovers. And yet in this, a fatal case, where the patient died speedily from absolute exhaustion, we find an evidently recent effusion of blood, minutely and highly organized with red vessels.

There was in this preparation no extravasation or infiltration of injection into pores or cells of the clot, but round and regular vessels with distinctly defined parietes, and possessing a uniformity of arrangement, that speaks at once as proof of the reality of the organizing process.

The fact of effused blood becoming organized, is by no means new. Mr. Hunter mentions the phenomenon with much circumstantiality in his lectures upon surgery, and he succeeded in injecting coagula, in a case of hydrocele, where it was afterwards found necessary to remove the testis. Plates are also given of this case. Mr. Palmer, however, in a note to this portion of the lectures, throws doubts upon the fact, thinking that "the situation and definite forms of the coagula would rather favour the idea that they proceeded from effused lymph, which became more or less intermixed with blood. Such an appearance is generally observed in cases of wounds and operations, but I am not aware of any unequivocal example of pure coagula, which have been observed to become vascu-

lar, although it is scarcely possible that this should have escaped observation, if it were at all frequent." (*Note of the editor of the lectures of John Hunter*, vol. i.) John Hunter further states that, "in many diseases, not inflammatory, the solids have a tendency to fall into those changes natural to animal matter, deprived of its preserving principle. The blood has no tendency to coagulate, nor the solids any power of raising inflammation, both having taken on the same tendency. In such diseases the principle and power are diminished, so that life is hardly able to preserve the matter from falling into the natural changes, though it has still a disposition to keep the vital parts or body moving." (*J. Hunter, ibid.*) To this it may be replied that in scurvy both the principle and the power are diminished in an extreme degree, and yet in Mr. Busk's case, not only was life able to preserve the effused blood from falling into a putrefactive state, but absolutely to organize it with innumerable vessels. May I not add that this is also "an unequivocal example" of true coagula becoming vascular, and capable of being most successfully injected?

It may be objected to the view that the organization of fibrine or other materials of the blood, if such exist, capable of becoming organized, is a speedier and more uniform process in weakened and cachectic constitutions than in others, that in cases of death within twenty-four hours after penetrating wounds in the abdomen, bands of fibrine have been found penetrated by new blood-vessels.

In such cases, the patient may have been previously healthy. Again, in some cases of strangulated hernia, an almost equally quick organization of fibrine has been recorded. In either of such cases, however, it may be observed, that the nervous power of the patient has received a shock, that places him *pro tanto* in a similar condition to one that has been previously reduced by disease. In each the pulse is quick, small or thready, the nervous energy depressed, and a state of collapse almost complete; yet effusion of fibrine proceeds, and the commencement of organization is set up.

Where the accident has been still more severe, and where the nervous system is utterly prostrated, as in certain cases of rupture of internal viscera, the patient commences to die at once; and no effort at the effusion of plastic lymph or production of new vessels is observed.

The growth of malignant, and perhaps of the more simple tumours, seems to afford another example of this theory. It is well known that the former become developed much more rapidly towards the close of life, when the patient has been worn down by confinement, want of exercise, and long suffering. And it is not improbable that occasionally the latter or more harmless forms of tumour are converted into malignant during some sudden or gradual deterioration of the general health.

From these morbid growths we must except those tumours which appear merely over-productions of some natural tissue; as adipose tumours, true exos-

toses, and the like. These hypertrophic tumours will often attain an enormous magnitude, without exercising any more pernicious influence over the health of the patient, than their mere size and incumbrance account for.

Acute inflammations accidentally arising in healthy individuals frequently pass into the suppurative stage, and argue, therefore, I presume, *a priori*, an organization of new vessels, from which the pus is secreted. The same may be said of the regeneration of parts after ulceration or slough. Yet it is to chronic inflammation, principally, that are attributable the disorganizing of tissues by effusions, and the permanent existence of those effusions by the development of blood-vessels.

It can also be scarcely doubted, that chronic inflammation is generally assignable to want of power in the arterial system; or, if that be considered as begging the question altogether, that its maintenance and long duration are due to general cachexy, since depletions, and the antiphlogistic system, aggravate, rather than lessen, the existing disease.

From these chronic inflammations we see result the increase of bulk and induration of organs. The hepatization of the lungs, for instance, is the effect of exudation of fibrine in the parenchyma of the organ, which becoming organized, frequently remains, during the rest of life, a vital structure; the same may be said of indurations of the liver, and other similar organs. These acquire bulk, or at least ponderosity, but, the disease once checked,

do not go on to grow, as in hypertrophy, or as is the case in malignant forms of disease.

What the law may be that is impressed upon these last products, at the moment of their origin, we are, as yet, profoundly ignorant; but simpler organized deposits appear eventually to take on the character of the tissue, whence they have proceeded. Thus granulations become cellular tissue and skin; effusions from bone eventually bone; loose cartilages in joints partake of the nature of the articulations; old membranous bands in the chest or abdomen are smooth, and similar to serous membranes.

The difficulty of explaining the origin and formation of new vessels in effused fibrine, has been much increased by our present more exact knowledge of the terminations, so to say, of the capillary or intermediate system of vessels. The old Hallerian doctrine, which was implicitly followed by John Hunter, and all physiologists, until a very recent period, that vessels did terminate by open extremities, allowed the supposition that these vessels were actually continued into the effused material. That they were extended either by additions to their extremities, or that the molecules of the blood were driven into the plastic fibrine, and so formed new channels for the circulation.

Since, however, we have learned to believe, that no vessel terminates by an open mouth, that arteries are ever continuous with veins through the intervention of the capillaries, and that these latter

vessels are a continuous, highly intricate and variously arranged system of anastomoses, it becomes very difficult, if not impossible, to explain the mode of formation of new vessels in fibrine.

If we imagine that the parietes of the capillary system, under inflammation, lose their tonicity, and are dilated, (which last is certain,) they may also be elongated in the direction of their length. In this way, the force of the circulation, acting *a tergo*, may stretch and thrust them forward into the newly deposited fibrine, and constitute the first of those vessels seen therein, and which are always continuous with the original vessels of the part.

The extremely twisted and looped state of these vessels, especially as exhibited in the drawings of granulations, exhibited to the Society by my friend, Mr. Liston, remind one very forcibly of the varicose conditions of the veins of the lower extremity; and if we conceive the almost innumerable capillaries of the matrix of such granulations, or of the inflamed tissues effusing the fibrine, forced or prolonged into it, we may have a faint idea of the mode of their production.

It is also in the cachectic or generally enfeebled states of the constitution, that we should naturally expect to find the greatest want of tonicity of the capillaries, which first leads to the exudation of the liquor sanguinis, and subsequently to the dilatation and elongation of the vessels themselves into the fibrine when consolidated.

Although the liquor sanguinis, containing the

fibrine in solution, may permeate, by exosmosis, the parieties of the minute vessels, it is clear no blood-corpuscle can so traverse; and hence no red globule can be found passing into the effused matters, unless the canals be continuous with the original capillaries.

If the red globules escape by rupture, we then find them in spots, more or less widely diffused, without order or arrangement, constituting true ecchymosis. This result is not unfrequently seen in acute inflammations, from the force and vigour of the circulation; as well as in fungoïd diseases, where the parietes of the blood-vessels seem to want, entirely, their proper tonicity, and are easily broken down.

The subject here briefly entered into is of vast extent, and appears to me interesting as a physiological inquiry; at the same time, it cannot be denied that in practice it would become important, should future inquiry determine that the organizable materials of the blood become sooner and more completely organized in the debilitated and cachectic subject than in the healthier and more robust constitutions.

A CASE

OF

RECOVERY FROM CUT THROAT,

IN WHICH BOTH THE LARYNX AND PHARYNX WERE EXTENSIVELY OPENED.

By R. A. STAFFORD, Esq.,

SURGEON TO THE ST. MARYLEBONE INFIRMARY.

READ MARCH 10TH, 1840.

JOHN SIMMONS, aged twenty-five, the unfortunate subject of this case, was a servant out of place, who in a fit of derangement, determined to commit suicide. With a razor he divided the larynx in full half its circumference, exactly between the os hyoides and thyroid cartilage, exposing its internal surface without wounding any important blood-vessel. He was brought into the St. Marylebone Infirmary by a policeman, October the 21st, 1839, and appeared in a very exhausted condition; having a feeble pulse and cold extremities. The wound had been dressed by another surgeon, and therefore it was not opened. The man expressed great penitence and contrition for the act he had committed.

He was consigned to the care of proper attendants, and directed to be kept warm in bed, and to have nutritious fluids, such as beef tea, milk, &c., &c.

As some cerebral excitement came on, twelve leeches were applied to the temples; the head was shaved and kept cool by an evaporating lotion, and an aperient medicine combined with a small quantity of tartarized antimony was given to him.

In the middle of the second night, whilst the back of the nurse who had been ordered to watch him was turned, he made an attempt to open the wound with an old blunt knife which he had secreted; and succeeded so far as to divide the sutures of the former wound, and to cut on into the pharynx. No vessel of any consequence was injured, and he coughed up only a little blood. The wound was brought together by two sutures, with the view of preventing the wide gaping which otherwise would have taken place, and it was lightly dressed. He breathed through the mouth.

From this period the food escaped through the wound in the pharynx, and it was necessary for him to be fed by an elastic tube being passed down the œsophagus into the stomach. The cerebral excitement and fever increased, and continued for several days. He was kept under strict restraint. Blood was frequently abstracted from the neighbourhood of the head: he was blistered and purged; took sudorifics; used freezing lotions and the cold douche; and at length symptoms of effusion into the ven-

tricles and pressure on the brain, being by stupor and dilated pupils indicated, he was salivated by mercurial friction. The head-symptoms from this treatment gradually subsided; but he was left extremely weak. Quinine, wine and nutritous diet were administered, and his strength increased. The wounds now began to heal. The wound of the pharynx being the lesser, first closed up, and afterwards that of the larynx. On the 9th of December the whole wound was completely cicatrized, but the voice of the patient was lost, and he could only speak in a whisper.

The remarkable feature in this case is, that so extensive a wound of the larynx and pharynx should have healed. It is so uncommon, that I have been unable to find another case of the kind recorded.

The obstinate determination of this man also to commit suicide is no less remarkable. We were informed when he was brought to the infirmary, that he had attempted it twice before; and when he left the hospital after his recovery, he was found suspended by the neck in a hovel at Dulwich; where, from the decomposition of the body, he must have been hanging for more than a month.

ON THE

STRUCTURE

OF THE

HUMAN PLACENTA,

AND

ITS CONNEXION WITH THE UTERUS.

By WILLIAM BLOXAM, Esq.,

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SURGEON TO QUEEN ADELAIDE'S LYING-IN-HOSPITAL;
AND LECTURER ON MIDWIFERY AT THE SCHOOL OF ANATOMY AND MEDICINE
ADJOINING ST. GEORGE'S HOSPITAL.

READ MARCH 24TH, 1840.

In offering the following observations to the notice of this Society, I will take the liberty of stating that my attention was drawn to this important and interesting subject, principally in consequence of the contradictory opinions which have been promulgated by individuals of the highest character, in reference to the intimate structure of the placenta.

Finding that the perusal of the greater part of the writings on the subject tended to leave the mind in the same unsettled state in which the study was commenced, I determined to spend some time in investigating the various points connected with it;

resolving, as far as was in my power, to preserve myself in perfect freedom from prejudice or preconceived ideas, and to be contented with becoming a faithful reporter of facts.

These examinations have extended over a considerable period, during which time every separate step has been again and again repeated.

Having carefully examined the structure of the placenta, I ventured to compare the results, at which I had arrived, with the investigations of others; and as may be naturally anticipated, many points which I considered *new*, were either wholly, or in part, *known*. There are, however, one or two other points, which, as far as I am aware, are not yet *recorded*, if *known*.

Convinced, as I am, that our knowledge of the structure and functions of this organ is exceedingly imperfect, and that there is yet ample field for future inquiry, I may be considered guilty of presumption, in offering the following remarks to the notice of the Society, particularly as I lay no claim to originality. Yet, with those who are acquainted with the difficulties of minute anatomy, I shall stand acquitted, should it be found that I have brought forward any evidence corroborative of the investigations of others, or have thrown out a single hint which may smooth the path of my fellow-labourers on the subject.

The only merit to which I venture to lay claim, is some degree of patience, and also fidelity, in recording what I have observed.

An opportunity was afforded me, some time past, of examining the uterus of a female, who died about thirty hours after a most severe labour.

When removed from the body, its volume equalled that of the impregnated uterus between the fourth and fifth month; and it was of an intensely red colour, almost amounting to the tint known by the name of Modena red, and approaching a state of decomposition. On dividing it perpendicularly from the fundus on its fore part, the inner surface was found to be completely covered by a coat of grumous blood. It was then carefully immersed in a vessel of water, and agitated from time to time; a fresh supply of water being poured on it till it ceased to become turbid.

The inner surface presented the following appearances, which are to be observed in Plate III., engraved from a drawing made by Mr. Perry, with his usual fidelity and skill.

The muscular fibres of the uterus, at those parts to which the placenta had not been attached, were perfectly visible in rounded columns, not unlike those of the carneæ columnæ of the heart; and no orifice of any description was to be seen on the most accurate examination.

At the upper and back part of the fundus, was a space, irregularly circular, of from six to seven inches in diameter, of a darker colour than the rest, to which the placenta had evidently been attached. This space was completely covered by a delicate flocculent membrane.

On carefully turning this membrane about, with a fine needle, numerous openings were observed in it, having a well-defined margin, and forming canals leading to the substance of the uterus. Some of these canals are sufficiently large to admit the little finger.

At the bottom of these canals may be observed openings on the surface of the uterus, having a well-defined edge, either of an elliptic or semilunar form, penetrating obliquely downwards into the substance of the organ: some of these, also, are from four to five, or even six lines in their long diameter.

I have now described two sets of openings. But there is also a third, which may be observed on looking into those last mentioned, when they will be seen of similar form, differing, however, in size, and, generally, much smaller. The direction of the channels into which they lead is, also, from above downwards; and it is particularly to be observed, that no two openings are upon the same meridian.

These openings lead into the large uterine sinuses, and the course of one of them is indicated by a piece of bougie, as seen in Plate III.

This sinus is lined by a smooth membrane, resembling that of the larger veins of the trunk, and is triangular in shape; the apex being turned towards the inner, and the base towards the outer wall, of the uterus. At its posterior angles, on each side, it receives the trunks of the smaller veins, in pairs, at distances of about nine lines apart; and at

its inferior portion, becomes continuous with the hypogastric veins.

It will now be necessary to refer to the placenta. But its structure at the completion of utero-gestation being the principal object of this paper, it is not my intention to enter on the question of its early development.

If a placenta which has been excluded by the natural efforts of the uterus be freed from the coagula attached to its uterine surface by gentle agitation in warm water, vessels of very delicate texture, varying in size from an extreme tenuity to the calibre of a line, will be found on its uterine surface.

The length of these vessels, (which from the irregular form of their free extremity are evidently broken off,) varies from two to six or eight lines; and, as far as I have observed, they are invariably found with a depressed line in their longitudinal axis, as we generally see the arteries after death.

In Plate IV. fig. 1, the subject of which was taken from the body of a phthisical patient, who died at the sixth month of utero-gestation, these vessels may be observed crossing from the uterus to the placenta. They are of small diameter, but this circumstance may probably be, in some measure, the consequence of the early period at which gestation had been arrested.

These vessels, which after making a complete circle, plunge suddenly into the surface of the placenta, are known by the name of the short curling arteries of Hunter. Their ultimate distribution will

be considered hereafter; this much may, however, be stated at this stage of the inquiry; that they are most probably the sources by which the blood enters the placenta, for the nourishment of the child.

The same vessels are beautifully shown in a preparation in the gallery of the museum of the Royal College of Surgeons, No. 3,540.

If we now place the placenta on a level surface, with its uterine side uppermost, a number of openings may be detected.

These openings are well seen in the wax cast of a placenta in my possession. In this cast, the edges of the openings have been slightly defined with black varnish, so as to distinguish them from the adjacent surface; and where the orifice is large, and has penetrated some considerable depth into the placenta, the bottom of the aperture has also been made black, so as to render it visible. Some of the openings approach the elliptic, some the circular form, whilst others, and the great majority of them, are semilunar.

These last-named openings penetrate obliquely the substance of the organ; and inflation of one of them will distend the whole of the lobe to which it belongs, and frequently a considerable portion of the lobes adjacent.

It is remarkable that the concavity of every one of these semilunar valves, for so they may be called, is turned, in some degree, towards the insertion of the cord.

Passing round the circumference of the placenta, is to be seen a sort of canal, Plate IV. fig. 2, lined

by a membrane exactly resembling in appearance the inner coat of a vein.

In this canal are many apertures, with semilunar openings directed in the same manner as the semilunar openings of the placental mass itself; and it receives numerous trunks of veins coming, *apparently*, from the membranes of the ovum.

Several of these openings have a bristle inserted into their mouths; and one of them is distended by a bristle which has been doubled.

The smooth lining membrane may be seen immediately beneath the bougie which has been introduced into the canal.

It may now be stated that in place of the placenta being of cellular structure, such is not the fact. If a vertical section be examined under water, it will be found to be composed of vascular structures arranged in the form of convolutions, which have given this erroneous impression; the cells being merely the interstitial spaces of the vascular arrangement, and presenting nothing in any degree resembling cavities with definite parietes.

Into this interstitial portion of the placenta, the semilunar apertures on the uterine surface of the organ lead, as may be seen in Plate V. fig. 1, where tallow coloured with carmine has been injected from one of these apertures.

I have repeatedly injected the interstices of an entire placenta from one or other of these orifices.

From the oblique mode in which they penetrate the organ, they appear to possess somewhat of the

action of a valve, as I am induced to believe they almost entirely resist the passage of fluids from the system of the mother towards that of the child: and in the gravid uterus already mentioned, size thrown into the spermatic arteries freely penetrated, (as may be seen in Plate IV. fig. 1,) the vascular system of the placenta; rendering it of a uniform redness, except under the highest magnifying power: whilst size, coloured blue with finely levigated smalt, was injected into the hypogastric veins, none has appeared to have reached the placenta; notwithstanding it can easily be traced in the sinuses of the uterus.

The *probable* inference, therefore, is, that the current of blood does not *enter* the placenta through those orifices.

It will be now necessary to refer to the distribution of the vessels called the curling arteries of Hunter, which appear to be the way by which the blood, or its nutritive principle, is conveyed to the placenta.

As has been already remarked, they are exceedingly numerous; of small calibre compared with the important function they perform, and from this fact I shall venture hereafter to deduce a conclusion of considerable consequence.

These vessels, immediately on their entrance into the placenta, appear to divide abruptly into an extreme number of smaller branches, so small, as to be perfectly undistinguishable by the naked eye; and even under a simple lens of high focus a sec-

tion of the placenta appears of an uniform colour; but under the microscope, they present perfect evidence of linear arrangement. These vessels appear to ramify very minutely in the convolutions of the placenta.

A vertical section of the organ presents them as a number of extremely minute points, and a magnified view of a small portion of placenta may be seen in Plate V. fig. 2.

With reference to the distribution of the umbilical vein and artery, the following circumstances may be observed.

It appears to me, from injection, and from the examination of the preparations in the various museums of this metropolis, that no injection has hitherto reached the vessels of the cord from the uterine arteries; it may be therefore inferred, that there is no actual communication with them by continuity of structure; but on observing the distribution of the umbilical vein at its extremities, it is found that its divisions are excessively minute, and in contact with the branches of the uterine arteries, ramifying also on the spongy tissue of the placenta.

As an injection thrown with extreme care into the umbilical vein will return occasionally by the arteries, the argument is apparently conclusive, that there is a union of these vessels, by means of a capillary system as well as an inosculation between the minute branches of the umbilical vein itself.

The umbilical artery has also two modes of termination; one, with the capillary system above men-

tioned, and a second, which I am not aware has been previously observed.

If the placenta be carefully examined under spirit, and the laminæ of the spongy tissue gently drawn asunder, the extreme branches of the umbilical arteries may be seen floating in the liquid, between the convolutions of the organ.

If one of these terminal branches be carefully detached, and received on a piece of glass under the spirit, and viewed by the microscope, its termination will be found as in Plate V. fig. 3. It seems to terminate in several tufts of vessels, bulbous at their free extremity, into which the colouring matter of the injection very imperfectly enters; but which, by occasional dots of vermillion, are proved to be prolongations of the canal of the vessel.

A singular peculiarity is observable in these vessels; namely, that they almost invariably form a loop resembling a figure of eight.

In those portions of placenta in which I have injected the interstitial structure with tallow from the semilunar valves of the uterine surface, I have been able, on melting the tallow, by pouring boiling alcohol upon a thin vertical section, to elevate these tufts of vessels on the point of a fine needle, in every instance; although they are so minute as not to be distinguishable without the aid of a good lens.

In reviewing these facts, the following conclusions appear to me deducible.

Firstly. That the blood enters the placenta through

the short curling arteries of Hunter; and that although their size is insignificant compared with the venous system of the uterus, yet their relative number being greater, a full supply of blood is insured to the organ; whilst by the smallness of their calibre, they prevent the maternal circulation from expending its full momentum on the system of the child, under the accidental shocks physical and mental to which the mother is daily liable.

Secondly. That these vessels ramify on the spongy tissue of the placenta, and are there in apposition with the extremities of the umbilical veins.

Thirdly. That it is highly probable, that some of the properties of the maternal blood pass into the circulation of the fœtus by this means, and having fulfilled its functions in the fœtal œconomy, the residue is returned to the placenta by the umbilical artery.

Fourthly. That from the free terminations of the umbilical arteries it transudes into the interstitial structure of the placenta; which, it may be remembered, is continuous with the semilunar apertures on its uterine surface.

Fifthly. That these apertures are applied to the openings on the internal surface of the uterus, and furnish the channel by which the blood, or its principles, are restored to the system of the mother.

As far as I am aware, there is no evidence of direct communication between the fœtus and its parent, furnished by the researches of comparative anatomists. Mercury, however, has been found

in the vessels of the fœtus after having been injected from the uterus. Here, perhaps, the weight of the substance employed may have conduced to the result.

In the preparation from which the drawing of Plate IV. fig. 1, is taken, it will be observed, that the injection of blue-coloured size, which has freely penetrated the venous system of the uterus, has not entered the substance of the placenta, although the openings of the venous channels are many times larger than those of the arterial system, which is minutely injected.

Was this injection arrested by the semilunar valves of the uterine surface of the placenta? It appears to me very probable.

With regard to the precise process which the blood undergoes in its accommodation to the necessities of the fœtus, we have no data to guide us; it may be a secretory process, or merely an exercise of those peculiar properties of the vascular system known as endosmose and exosmose.

I cannot conclude this paper without a brief observation on the mechanical arrangement of the uterine orifices for the prevention of hæmorrhage.

In regarding the immense size of the apertures of the venous sinuses, as in Plate I., one feels a degree of astonishment that hæmorrhage is not more frequent, and more fatal; but when it is remembered that the essential property of the uterine fibre, at the full term of gestation, is that of contractility, and that by the exercise of this property the

orifices of the deeper seated sinuses must be closed, by the more internal layer of muscular fibres, inasmuch as these apertures are not placed on the same meridian, our surprise ceases.

It is probable, that independently of this mechanical arrangement, the flow of blood from the more superficial openings may be arrested by the formation of coagula, a process for which the flocculent structure of the decidua seems highly favourable.

TERMINATION OF THE CASE

OF

WILLIAM CHANDLER, A CHILD THREE YEARS AND SEVEN MONTHS OLD,

AFFLICTED WITH

DRY GANGRENE,

OF WHICH AN ACCOUNT WAS PUBLISHED IN THE TWENTY-SECOND VOLUME.

By S. SOLLY, Esq., F.R.S.

READ APRIL 14TH, 1840.

Notwithstanding the favourable character of my last report (April 22nd, 1839), this poor child lived only until the following September. For a knowledge of the changes which took place in his condition during that period, I am again indebted to my friend, Mr. Bury, as I then had no opportunity of visiting it myself until after the post mortem examination had been conducted.

But the unsatisfactory nature of the evidence of the cause of this destructive malady, induced me to extend the examination further than it had been carried previous to my arrival; not, however, I am sorry to say, with any additional elucidation. I carefully dissected the sympathetic nerve in the neck,

chest, and abdomen, but the dissection revealed nothing abnormal, either in structure or distribution. I traced the arteries a little further from the heart, and dissected them in the stumps; but there was nothing decidedly abnormal, either in structure or distribution; no appearance of ossific deposit, or other morbid change; they might have been rather smaller than usual, but even this was doubtful. And I candidly confess, than I am still as ignorant of the cause of the gangrene as I was before the dissection was commenced, notwithstanding the careful manner in which it had been conducted in the first instance by my intelligent friend, Mr. Bury, and my own subsequent investigations. I still, however, believe that there must have been some minute morbid change, either in the solids or fluids, or congenital deformity, which escaped our observation. There was one mode of research which I now much regret did not then occur to me, namely, a microscopical examination of the blood, inasmuch as that invaluable instrument might have revealed some changes in the nutritious fluids which the naked eye could not detect;—but to return to the sequel of the case, as detailed by Mr. Bury.

"1839—July 21st.—The dry gangrene is recommencing in all four extremities, or rather the remnant parts of those already destroyed by that very remarkable process. The upper stumps are swollen and livid, and indicate a line of separation parallel with each acromion process, and al-

most circular. The right leg is in the same state, up to the middle of the calf, and there is a large patch also over the patella, and front of the knee. The left leg, from the point of the stump to the middle of the thigh, is likewise similarly affected. On the right cheek, a superficial eschar is to be seen, but not to be termed gangrenous. There is an abundant miliary eruption diffused over the whole body, and accompanied by considerable feverishness. This began two days ago, and the gangrene six, during the first two of which the child experienced very severe pain in the parts. He is now exceedingly languid and listless, and has taken little or no nourishment. The tongue is clean, but dry; and the pulse as feeble and rapid as heretofore. Bowels and kidneys act naturally. Mr. Bayley has prescribed a mixture, containing ammonia, with hyoscyamus, &c. &c. The extremities are kept warm by flannel, &c., and the local applications consist of warm poultices, with slightly stimulating ointments.

"August 9th.—The soft parts of the left lower extremity, below the middle of the thigh, as alluded to in the report of last month, came off on the 6th instant, in a dead and shapeless state, leaving the shaft of the os femoris bare, but deprived of its condyles. There is, however, a healthy granulating surface on this fresh stump, affording a free purulent discharge. The right foot is nearly detached just above the ankle joint; a few days only being required ere detachment is effected. On the shoulders the disease has apparently stopped suddenly, as they

present merely superficial crusts of gangrene, shortly about to be thrown off. A similar patch has exfoliated from the front of the right knee, and is succeeded by a pretty healthy wound. The constitutional vigour of the child is astonishingly recruited. He eats well, and digests properly; the countenance is as good as I have ever seen it; there is no perceptible change in the pulse, or state of the secretions; and his sleep has been abundant and good.

"September 8th.—This morning the poor child was found dead in his cradle, about eight o'clock; having sunk without a struggle or a groan, and apparently in a state of sleep. His step-mother was lying in an adjoining bed at the time, and had given him a little cold milk and water at five o'clock, which she had done at intervals during the night, and several preceding nights, thirst having been somewhat urgent and incessant. The right foot was cast off in a few days after my last account, leaving a healthy surface about the middle of the leg, and the tibia and fibula bare and protruded beyond this point. Emaciation has advanced very considerably, and for the last two days the granulating surfaces on the lower extremities had ceased to discharge, and the appetite slightly, and only slightly, failed yesterday. With regard to the other symptoms, there was no perceptible change, and, consequently, the child's decease was at the moment unexpected.

"September 9th.—I examined the body this day, about thirty hours after death. The emaciation was great, shown especially over the sternum, and the

skin contained the remains of the miliary eruption, in the form of small dried scabs. There was a trifling subcutaneous hæmorrhagic effusion on the left cheek, nearly equal to the size of a shilling, resembling that of purpura, and attributed to the child's constantly reclining his head (which was large) on that side. A like spot, much smaller, was likewise visible on the epigastrium. The stumps of the arms, about an inch in length from the fold of the axilla, were conical, and nearly healed, their apices being enclosed in a small crust, which was dry, and very dark in colour. The left thigh presented in its middle a small granular surface, surrounding the bone, by no means indicating want of vital action, beyond which the shaft of the bone itself projected, undiminished in size or length. In the calf of the right leg there was the same kind of amputation observable, with the tibia and fibula protruding, but the wound was dark, and the integuments above were of a deep Modena hue, showing that mortification was here re-established and spreading. This had, in fact, been exhibited during the last forty-eight hours of life. The wound over the knee was contracted in dimensions, but purple. To the *internal* examination I turned with the most intense interest. Both lungs were remarkably pale, and in a state of anæmia. The pericardium was thin, but naturally strong, and contained a small quantity of clear serum. The heart itself, quite of ordinary size and weight, was situated normally, and with the exception of the muscular fibres of both ventricles being

somewhat pallid, showed no structural change deviating from the standard of health. All four cavities, and all the primitive trunks, venous as well as arterial, were completely filled with very dark coagulated blood, there being no difference in the colour of that in the right and left sides of the heart, or of that in the two sets of vessels. The arch of the aorta was filled in this manner, but there was no obstruction beyond it. Both femoral arteries were remarkably shrunk, being obviously much less in calibre than their veins, very pale, and were not patulous on division with the knife. The liver was bloodless, though otherwise healthy; and this may likewise be said of the other abdominal viscera."

OBSERVATIONS

ON

INJURIES OF JOINTS,

AND

THEIR TREATMENT.

By RUTHERFORD ALCOCK, Esq., K.C.T., &c.

LATE DEPUTY INSPECTOR-GENERAL OF HOSPITALS WITH THE AUXILIARY FORCES OF PORTUGAL AND SPAIN;

AND LECTURER ON SURGERY.

READ APRIL 28TH, 1840.

FIRST PART.

Among the complicated injuries which have come under my care, in great numbers, during the last ten years, cases in which the articulations are implicated in the first instance, or subsequently to the receipt of a wound or injury, by the extension of diseased action, have attracted much of my attention and careful consideration. It always seemed to me, that this important class of cases had met with much less attention, particularly from surgeons in civil practice, than they merited, by their complicated character, and the frequency of fatal results, both as regarded the life and the limb of the patient.

On wishing to compare the results of my own experience with that of others, I have been still more forcibly struck with the meagreness of the materials bearing any reference to injuries of joints. These, too, are scattered in isolated fragments through a great number of works, Medical Journals, Transactions, &c. I have not found any monograph on the subject; and when all the fragmental information is gathered together, no satisfactory or conclusive classification of the various kinds of injuries, or definition of principles of treatment, in reference to their respective characters, could be formed from such data.

This, it must be allowed, is a serious evil; and I have been led, in consequence, to make an attempt to supply the omission by the present contribution to the surgical pathology of joints.

In reference to what has been already done, a few brief observations will suffice. Hey merely relates two or three cases, chiefly of incised wounds, the edges of which being brought together, and treated antiphlogistically, did well; and one badly lacerated wound of arm, inflicted by a garden roller passing over it.

In none of the various *Memoires de Chirurgie*, Encyclopædias, or Surgical Dictionaries, have I found any but the most brief allusions to the subject. In the German, American, French, and English Medical Journals, a few cases and isolated observations are to be met with; but the little that has been done towards fixing principles of treatment, and

classifying these injuries in reference to such principles, is to be found in the works of Boyer, Larrey, Guthrie, Hennen, Thomson, and Dupuytren.

Although many are the facts, the observations, and opinions, which from these sources may be collected, yet they are, for the most part, as I have observed, fragmental, often at variance with each other, and requiring ample personal experience to enable the reader to frame anything like comprehensive and consistent views from them, which might embody into a system these injuries, and establish certain principles for their treatment. There are many difficulties attending any attempt of this nature; for while it is necessary to retain the facts which are sufficiently numerous and defined to be generalized, it is not less essential that all cases should be carefully distinguished which are unusual and exceptional, and therefore unfit and unsafe guides or data on which to found principles of practice for general application. Nothing can be more fatal to the advancement of surgical science, or more fraught with mischief, than a hasty generalization of a few facts, many of which may prove to be mere exceptions to a more general and utterly unheeded principle.

In the class of injuries under consideration, this danger is most especially evident. Many are the extraordinary and most unlooked-for successes attending the treatment of forlorn cases of injured joints. Were general rules or principles of treatment to be founded on these cases, which are but

units among thousands giving contrary results, and were no reference made to those greater numbers, which enlarged experience shows must perish in vain attempts to save limbs, an immense sacrifice of life and increase of human suffering would inevitably follow.

In all complicated injuries of the extremities, the chief difficulty is, to decide upon the cases which demand amputation as a primary measure, and those in which the attempt to save the limb may be judiciously made. By a limb saved, I do not mean one with the wounds healed, having nevertheless the extremity contracted, bent, motionless, or otherwise useless; cases, which by a loose kind of phraseology, are often termed "limbs saved." The object of saving a limb is that it may be useful. If this is not the result, the member, by merely hanging to the body of the patient, is lost in my estimation, as truly as if amputated; but with the additional circumstances of being converted into a source of misery to the sufferer, an impediment to the free motion of the rest of the body, and often a cause of irremediable ill-health. Such cases I hold to be among the worst specimens of bad and injudicious surgery.

But this is not the *only* question to be solved in these injuries. Occasionally the excision of the articulating end of a bone, and other operative means, may obviate the necessity of amputation, by removing the seat of injury, and yet a useful limb be preserved. It is of the utmost importance to define

what are these operative means, and in what cases and circumstances they are applicable. On this part of the subject, the majority of writers on domestic surgery are silent, or nearly so.

With respect to the first question of amputation, which has attracted much attention, the definitions of the classes of injury are few, and, I am inclined to believe, so general and vague, as in some instances to lead to misconception and error of the most mischievous kind. Thus Messrs. Larrey and Guthrie both state generally, that "if the articular heads are much broken, ligaments, &c., lacerated, they are cases for primary amputation." And also, that when the ball is lodged in the thickness of the articular head, and not easily extracted, amputation is to be resorted to. This rule I hope to be able to show requires limitation, and the injury described ought not to be classed with those indubitably requiring immediate amputation. And again: "I most solemnly protest," says Mr. Guthrie, "I do not remember a case to have done well in which I knew the articulating end of the femur or tibia to be fractured by a ball passing through the joint." However correct as a general rule, this, like the one preceding, is somewhat sweeping; and, unless certain distinctions be made, is calculated to lead to amputation in cases of this class, when a useful limb might be saved.

Dr. Hennen lays it down unhesitatingly also, as a law of military surgery, that no lacerated joint, particularly the knee, ancle, or elbow, should ever leave

the field unamputated. I purpose to show that this rule includes many cases where such practice would neither be judicious or justifiable. Mr. Guthrie makes an exception of fractures of the patella, and Larrey enforces an additional doctrine, that when a a large ginglymoid joint has been extensively opened with a cutting instrument, and *blood is extravasated* into the joint, immediate amputation is necessary. I feel strongly, from the results of my own experience, the necessity of protesting against this class of injuries being, without reservation, included with those unequivocally requiring immediate amputation. Many cases of this nature must occur, obviously requiring such a measure; but some may be saved, and, at all events, reserved in that hope, subject to the chance of a secondary amputation, should the progress of the case be unfavourable, without any great increase of peril to life.

Dr. Thomson, in his Report of Observations made in the Military Hospitals of Belgium,—for to the military surgeons I am compelled to refer, almost exclusively, for any information, on this subject,—defines another class, and lays down a rule, which I believe also, from observation, to be unnecessarily destructive to limb.

He says: "Musket-balls, in passing through the femur, near to the knee-joint, produce fissures of the condyles, which generally communicate with the articulation. These cases, like those in which the bullets have passed directly through the joint, *require immediate amputation.*"

Dupuytren, in his "*Traité Theorique et Pratique des Blessures,*" confirms one of the observations I have already made against a sweeping rule for amputation in fractured ends of bones, by asserting that in cases where balls pass through the osseous and spongy ends of bones, merely making a hole, the articulation may often be saved; that is, he defines a class of injuries coming within the more general heads of those described by Messrs. Larrey, Guthrie, and Thomson, in which their rule of practice, if adopted, would be erroneous, and unnecessarily destructive.

M. Dupuytren, in reference to this subject, only further alludes to the necessity of amputation, when an articulation is completely torn and spoiled.

In reference to the second question, viz. the excision of articulating ends of bones, the graver injuries of joints were, long, too commonly considered to offer only two alternatives, to amputate, or to save the limb without operation. Improvements in surgical science, and the ample opportunities afforded by the great wars from 1790 to 1815, of testing bolder plans of treatment, have demonstrated that the surgeon's resources are by no means so limited. And in order to save time, and dismiss this part of the subject at once, while I glance at the opinions and facts of others, I will add the results of my own observation.

Mr. Guthrie has some remarks upon the inattention of the medical department of the British army, during the peninsular war, to the applicability of

the operation of excision in a great number of cases where, as often happens, the head and neck alone are injured. I had, in a somewhat more limited sphere, to regret, among well-educated medical men, who had studied, within so late a period as the last twelve or fifteen years, a similar disposition to remove at once the limb, if the head of the bone was implicated. I have several preparations giving admirable specimens of injuries of the shoulder and elbow, where a limb might probably have been saved at the expense of a portion of the articulating ends or surfaces.

Dr. Thomson, in his "Observations" on the cases resulting from the Battle of Waterloo, although he alludes to many severe injuries, where the attempt was making to save the limb, does not speak of excision of the head, or its removal, in any one instance. Although he proves, therefore, as Mr. Guthrie had it at heart to show, in another part of his work, that all cases were not indiscriminately submitted to the amputating knife, he certainly does not tell us of the adoption of the operative means, by which alone the treatment of severe fractures into the joint is likely to be followed by success.

Excision of the head of the femur has been practised. M. Paillard, in his "*Relation Chirurgicale du Siège d'Anvers*," gives an example of resection of the head of the thigh bone for a comminuted fracture of the neck,—six inches of the bone, including the head and neck, were removed with very trifling

loss of blood. During the first few days, some chances of success were observed; but the limb quickly afterwards became gangrenous, and the patient died on the ninth day. Mr. White, of Manchester, was the first to propose this operation, about the middle of last century. One case only of its actual performance had been related before M. Seutin's, by an American, and was not considered, I believe, as very certainly authentic. The result of M. Seutin's case is not likely to lead many to perform an operation which, I cannot but think, very little calculated to save a useful limb under the most favourable circumstances. I believe, however, that Mr. White, Surgeon to the Westminster Hospital, has performed a similar operation for carious disease of the head of the femur, and with good result. In wounds of the shoulder-joint, Larrey speaks of ten cases in which he avoided amputation by extracting or removing the head of the humerus; one died of fever, two of scrofula, and one of plague. In some there was anchylosis, in others a species of joint.

In 1794, M. Percy showed, in Paris, nine successful cases, where the head of the humerus had been removed; and Larrey again relates a case where the top of the shoulder was struck by a four-pound shot, merely breaking the skin superficially, but fracturing underneath the head of the humerus, the scapular end of clavicle, the acromion and coracoid processes. He cut down upon the broken fragments, and removed them, including the head of the humerus. The wounds cicatrized, and the arm

anchylosed at the shoulder, by the gradual approximation of the shaft. In another similar instance there was an artificial joint formed, and slight movement in every direction, although the arm seemed to have less strength than existed in the former case, where there was anchylosis. Mr. Guthrie also speaks of similar cases of cannon-shot injuries occurring in the British army; but all were fatal. He relates, however, several cases from musket-shot, where arms were saved by removing the head from the cavity, together with any other fragments of the neck.

These facts are quite sufficient to prove that this operation, first proposed as a means of saving an arm in disease,—and the first case was made known by White, of Manchester, in 1769, who had recommended it for caries of the joints, arising from spontaneous disease,—is perfectly applicable to cases of severe fracture and injury to the bones of the articulation. They prove that even the fearful injuries inflicted on the shoulder by cannon-shot may sometimes be so treated with success, although, it is to be feared, with a greater risk to life than that arising from immediate amputation. But in musket-shots merely shattering the head of the bone, the operation of excision of the head may be resorted to, with the confident anticipation of success in a majority of cases. This all past experience sufficiently confirms.

This operation, as applied to the knee-joint, subjects the patient to imminent risk, and the result

can never be very satisfactory. This opinion alike applies to cases of caries and of injury. The cases that are on record by no means bear out the views of those who have recommended its adoption. With the opinion I have just expressed, I have never recommended or performed the operation, although a great number of cases favourable for it have fallen under my observation, had I thought the operation promised any success commensurate with the risk to life and chances of a useless limb, even if the patient should recover.

To conclude at once with the articulations of the lower extremity, in reference to these operative means, I will observe that in injuries of the ankle, excision, whether of the astragalus or the end of the tibia, may form a resource; and examples are on record, when both the one and the other have been removed with success. If a shot, however, pass directly through the articulation, splintering articulating surfaces of both tibia and astragalus, I believe amputation to be almost invariably indicated. The excision or removal of the whole or portions of one of the articulating surfaces forming the ankle joint will more frequently be found expedient in the dislocations attended with laceration occurring in civil life,* where it is often impossible to return the pro-

* I have been watching a case of partial excision of the external malleolus in a severely lacerated and partially fractured ankle-joint. Since this paper was read, the patient is under the able hand

jecting parts to their proper position, than to gun-shot injuries more extensively shattering the bone, and contusing all the parts in the vicinity.

Very serious injury of the elbow-joint often admits of the limb being saved, even after portions of the articulating ends may have been removed, or the olecranon dissected out, without the arm being rendered useless. Finally, excision of the ends of the articulating bones may be practised with advantage in a great number of cases in which those parts alone are involved. This operation has been performed many times with good success in cases of disease; it is still more applicable to injuries. Portions of the articulating surfaces I have dissected out with the happiest result. Much valuable information relative to the operation of excision in the elbow will be found in a work on carious joints, edited by Dr. Jeffray, and also in a treatise of Mr. Symes, of Edinburgh. This is, however, neither so simple an operation in the performance, nor so likely to do well in the end, as similar cases in the shoulder-joint, which, of all the articulations, is the one to which this operation is best adapted. Of the total excision of the articulating ends of the elbow, I find no instance in the annals either of British or French military surgery, although domestic surgery has furnished us with many examples for dis-

of Mr. White, of Westminster. The result is most satisfactory, the progress of the case having been marked by scarcely any constitutional disturbance.

ease. This can only have arisen from the indisposition of medical men to apply the principle of the operation to cases of injury.

The wrist alone remains for consideration in reference to excision. It is often difficult to decide upon the course to be adopted in wounds and lacerations of this articulation. Patients occasionally recover from very severe injuries, such as the passage of a musket-ball through the carpal bones, or the laceration of a saw passing into the articulation with the hand. (See Case X.) Yet these are cases at best eminently uncertain in their results; and although much may be adventured, but little should be promised or hoped. Excision of the end of the radius, the removal of a dislocated carpal bone, or of the head of a metacarpal bone, may occasionally be adopted, and with success, to prevent the loss of a hand. It is impossible, however, to predict, with any certainty, the degree of inflammatory and suppurative action which may ensue; and on this chiefly hangs the issue of the case.

If there be crumbling of one or more of the carpal bones, provided the tendons are not divided across, these fragments may be removed, and an attempt made to save the hand. But if there be comminution involving the greater part of the articulation, instead of its lateral extremities merely, it rarely happens that the tendons are not extensively torn across also; and then amputation would better be performed at once, and no attempt made by excision to remedy the mischief.

Of the six principal articulations, I have to observe therefore, that excision of the ends of bones offers a great and valuable resource in four, viz., the shoulder, elbow, wrist, and ankle: and in the order here given, is it most applicable. The hip and the knee are not articulations in which this operation seems to be expedient. The most favourable cases are those in which the head of the humerus alone is implicated, and that by a musket-shot.

The greatest amount of information on injuries of the articulations which I have found collected in an available form in any one work, is in Mr. Guthrie's Treatise on Gun-shot Wounds. But as far as I have been able to ascertain, valuable as the facts and observations may be, which have been placed on record by the military surgeons of the past and present century, on complicated injuries of joints, there is yet wanting a treatise which shall fulfil the object I have in view in this paper.

I do not here make any reference to the valuable work of Sir Astley Cooper on Dislocations. In that treatise any complicated lacerations or wounds of joints are incidental, and only form the exceptions, as it were, to those cases which form the bulk of the work, devoted simply to the displacement of articular surfaces—injuries which take place, in the great majority, without accompanying wounds, fractures, or the lodgment of foreign bodies.

This brief retrospective glance will, I hope,

serve to show, that the attempt to establish certain fixed and comprehensive principles of treatment, in reference to a maturely digested classification of the various kinds of injury, is not a labour of supererogation.

SECOND PART.

GENERAL RESULTS.

Before I proceed to the classification of cases and reference to individual examples, a few observations will not be misplaced on some of the more striking general results of these injuries with regard to the frequency of their occurrence in military practice, and to the treatment, progress, and termination of cases of injury to the articulations generally.

I was first led to these results by a careful analysis of about one hundred cases of severe injury to joints, detailed notes of which I had preserved, for a period when more leisure, than my duties at the time allowed, should enable me to undertake the labour. Many of these results are of interest and practical importance. Such of them as are numerical I have thrown into a tabular form, as the most condensed mode of expressing them. I cannot help observing,

that were statistics of the progress and results of diseases and injuries more closely and frequently applied, wherever large numbers of cases are under observation, much valuable information would be obtained that is now lost to the profession,—information too that by no other means can be made practically to bear on classes of maladies, and their principles of treatment. Doubtless, if figures are employed otherwise than conscientiously, and with the greatest care and judgment, to avoid classing together dissimilar facts under parallel heads, they may be made a more pregnant source of error than any argument or description by words; but this can in no degree militate against their proper use, and their importance when so applied.

The results of these tables, which, for the sake of accuracy and perspicuity, include only gun-shot wounds, may most conveniently be adverted to, under separate heads. Although the number of injuries, such as occur in civil life, which have come under my notice during the last twelve years, have been very considerable, yet I could not from my notes attempt to include *all*, and, whatever the number collected, they would, at best, be fragments, affording, therefore, the data of no one complete series. This is precisely a danger that it behoves any one resorting to statistics for the decision of scientific questions, to avoid. If *all* the cases of a given period be included, they form sufficient grounds for just conclusions; but if one case be omitted, the whole

return is falsified; it may be a death or a cure, or an amputation; but whatever the termination, its omission alters the legitimate conclusion. How much more incorrect must be a return, where it is impossible to state how many may have been omitted? It is worse than useless, however accurate may be the details actually produced.

RETURN, No. I.—*Results of Gun-shot Fractures, involving Articula-*
Cases not operated on, including the

Site and Nature of Injury.	Intermediate Amputations.									Secondary Amputations.								
	Number of Cases.			Cured.			Died.			Number.			Cured.			Died.		
	Joints primarily involved.	Joints secondarily involved.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.
HIP. External Circumstances																		
Musket Shot — Favourable																		
Musket Shot — Partially unfav.																		
Musket Shot — Unfavourable																		
Total																		
SHOULDER.																		
Cannon — Favourable																		
Cannon — Partially unfav.																		
Musket — Favourable																		
Musket — Partially unfav.																		
Musket — Unfavourable	1		1				1		1									
Total	1		1				1		1									
KNEE.																		
Cannon — Favourable																		
Musket — Favourable	1		1				1		1	6		6	3		3	3		3
Musket — Partially unfav.											1	1		1	1			
Musket — Unfavourable	2		2				2		2	2		2				2		2
Total	3		3				3		3	8	1	9	3	1	4	5		5
ELBOW.																		
Cannon — Favourable																		
Musket — Favourable	1		1	1		1				1		1	1		1			
Musket — Partially unfav.																		
Musket — Unfavourable																		
Total	1		1	1		1				1		1	1		1			
ANKLE.																		
Cannon — Favourable										1		1	1		1			
Cannon — Partially unfav.	1		1	1		1												
Cannon — Unfavourable																		
Musket — Favourable		1	1		1	1												
Musket — Partially unfav.																		
Musket — Unfavourable	1		1	1		1												
Total	2	1	3	2	1	3				1		1	1		1			
WRIST.																		
Cannon — Unfavourable																		
Musket — Favourable										1		1	1		1			
Musket — Partially unfav.																		
Musket — Unfavourable										1		1	1		1			
Total										2		2	2		2			
TOTAL	7	1	8	3	1	4	4		4	12	1	13	7	1	8	5		5

tions, Amputations,—including all in two Periods of about one Year each. Series of Thirteen Months only.

Cases not operated upon.									Total Results of Treatment and subsequent Amputations.						Primary Amputations.			General Result.		
Number.			Cured.			Died.			Cured.			Died.								
Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Cured.	Died.	Total.	Cured.	Died.	Total.
	1	1		1	1					1	1							1		1
2	1	3				2	1	3				2	1	3					3	3
2	2	4		1	1	2	1	3		1	1	2	1	3				1	3	4
1		1				1		1				1		1	1		1	1	1	2
															1		1	1		1
															3		3	3		3
1		1				1		1				1		1	2		2	2	1	3
1	1	2	1	1	2				1	1	2	1		1	1	1	2	3	2	5
3	1	4	1	1	2	2		2	1	1	2	3		3	8	1	9	10	4	14
															1		1	1		1
5	3	8	1	3	4	4		4	4	3	7	8		8	3	1	4	10	9	19
3	1	4	2		2	1	1	2	2	1	3	1	1	2				3	2	5
10		10				10		10				14		14	1	3	4	1	17	18
18	4	22	3	3	6	15	1	16	6	4	10	23	1	24	5	4	9	15	28	43
															1		1	1		1
3	5	8	3	5	8				5	5	10				2		2	12		12
2		2	1		1	1		1	1		1	1		1				1	1	2
1	1	2	1	1	2				1	1	2					4	4	2	4	6
6	6	12	5	6	11	1		1	7	6	13	1		1	3	4	7	16	5	21
									1		1							1		1
									1		1				1		1	2		2
																1	1		1	1
	1	1		1	1					2	2							2		2
1		1				1		1				1		1					1	1
									1		1							1		1
1	1	2		1	1	1		1	3	2	5	1		1	1	1	2	6	2	8
																1	1		1	1
2	2	4	2	2	4				3	2	5							5		5
1		1	1		1				1		1							1		1
1		1	1		1				2		2							2		2
4	2	6	4	2	6				6	2	8					1	1	8	1	9
34	16	50	13	14	27	21	2	23	23	16	39	30	2	32	17	11	28	56	43	99

RETURN, No. II.—*Results of Gun-shot Fractures involving the Articul-*
Including a Period of

Site and Nature of Injury.	Intermediate Amputations.									Secondary Amputations.								
	Number.			Cured.			Died.			Number.			Cured.			Died.		
	Joints primarily involved.	Joints secondarily involved.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.
HIP. Circumstances																		
Musket — Favourable .																		
Musket — Partially unfav.																		
Musket — Unfavourable .																		
Total .																		
SHOULDER.																		
Cannon — Favourable .																		
Cannon — Partially unfav.																		
Musket — Favourable .																		
Musket — Partially unfav.																		
Musket — Unfavourable .	1		1				1		1									
Total .	1		1				1		1									
KNEE.																		
Musket — Favourable .										6		6	3		3	3		3
Musket — Partially unfav.											1	1		1	1			
Musket — Unfavourable .	1		1				1		1	2		2				2		2
Total .	1		1				1		1	8	1	9	3	1	4	5		5
ELBOW.																		
Cannon — Favourable .																		
Musket — Favourable .										1		1	1		1			
Musket — Partially unfav.																		
Musket — Unfavourable .																		
Total .										1		1	1		1			
ANKLE.																		
Cannon — Favourable .										1		1	1		1			
Cannon — Partially unfav.	1		1	1		1												
Cannon — Unfavourable .																		
Musket — Favourable .																		
Musket — Partially unfav.		1	1		1	1												
Musket — Unfavourable .																		
Total .	1	1	2	1	1	2				1		1	1		1			
WRIST. Musket — Favourable .										1		1	1		1			
Musket — Partially unfav.																		
Musket — Unfavourable .																		
Total .										1		1	1		1			
TOTAL . .	3	1	4	1	1	2	2		2	11	1	12	6	1	7	5		5

ations,—in Cases Amputated,—in Cases treated without Operation.
about thirteen Months.

Cases not operated upon.									Total results of Treatment and subsequent Amputations.						Primary Amputations.			General Total.		
Number.			Cured.			Died.			Cured.			Died.								
Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Prim. Inv.	Sec. Inv.	Total.	Cured.	Died.	Total.	Cured.	Died.	Total.
	2	2		1	1		1	1		1	1		1	1				1	1	2
2		2				2		2				2		2					2	2
2	2	4		1	1	2	1	3		1	1	2	1	3				1	3	4
1		1				1		1				1		1					1	1
															1		1	1		1
															2		2	2		2
1		1				1		1				1		1	2		2	2	1	3
1	1	2	1	1	2				1	1	2	1		1	1		1	3	1	4
3	1	4	1	1	2	2		2	1	1	2	3		3	6		6	8	3	11
5	3	8	1	3	4	4		4	4	3	7	7		7	3	1	4	10	8	18
2	1	3	1		1	1	1	2	1	1	2	1	1	2				2	2	4
7		7				7		7				10		10	1	2	3	1	12	13
14	4	18	2	3	5	12	1	13	5	4	9	18	1	19	4	3	7	13	22	35
															1		1	1		1
3	5	8	3	5	8				4	5	9				2		2	11		11
2		2	1		1	1		1	1		1	1		1				1	1	2
1		1	1		1				1		1					4	4	1	4	5
6	5	11	5	5	10	1		1	6	5	11	1		1	3	4	7	14	5	19
									1		1							1		1
									1		1							1		1
															1		1	1		1
	1	1		1	1					2	2							2		2
1		1				1		1				1		1					1	1
1	1	2		1	1	1		1	2	2	4	1		1	1		1	5	1	6
2	2	4	2	2	4				3	2	5							5		5
1		1	1		1				1		1							1		1
1		1	1		1				1		1							1		1
4	2	6	4	2	6				5	2	7							7		7
30	15	45	12	13	25	18	2	20	19	15	34	25	2	27	14	7	21	48	34	82

The Return No. I, embraces all the cases occurring within a given period; to which I have added all the amputations from such injuries, not only for the same, but during several additional periods. As the periods embraced by the cases and the amputations do not therefore correspond, Return No. II, has been formed, giving all the cases treated or amputated within a given time, *and no others*. Each of the Returns will be found to have its legitimate use.

I have already claimed the attention of the Society to some observations on certain classes of injuries to joints usually met with in the accidents of civil life; and the object of this paper is to include both those of civil and military life in the general principles which I hope to show sufficient grounds for establishing. Nor can I be charged with any want of judgment, I trust, in thus including both within the limits of the same paper. I can only look upon gun-shot injuries as different from any other class, occasioned by machinery, the fall of weights, the passage of carriage-wheels, &c., inasmuch as they are in general of a *far more complicated and embarrassing nature*. I should not indeed occupy the Society's time by any relation of facts connected with casualties of the field, were I not convinced that any principles of treatment or practice established for them, are not less applicable to all severe and complicated injuries from whatever cause proceeding. It may be safely assumed, that whatever renders more simple and certain in its re-

sults the treatment of the most complicated forms of injury, cannot but tend to diminish any doubt or difficulty attached to cases originally less complicated in character; and that the severest tests to which any principle of treatment can be subjected, are the results of its application to the most complicated injuries. The large numbers of injuries brought at one period under observation in military hospitals, under the same general circumstances and plans of treatment, afford an opportunity and a facility for drawing practical conclusions and statistical results, such as years cannot with equal perfection furnish in any civil hospital.

As all the cases included in the tabular Returns have been admitted in military hospitals, under my sole direction, and treated in accordance with certain general principles, these once explained will apply to all, and prevent a great deal of repetition in relating individual cases, besides leading to the better appreciation of the general results.

I have classed all injuries of joints under three heads. I need merely so far define them at present as to say, that the first comprises those varieties of injury where in the majority of cases the limb may be saved, and where as a general rule it should be a principle of practice to attempt the cure.

The second contains what may be considered a doubtful or intermediate class. It comprises cases in which we find the difficulties both as to the diagnosis and line of treatment are considerably in-

creased. They can be grouped neither like the first class, as injuries in which the attempt to save the limb may be made in the majority with good result; nor with the third class, where amputation is imperatively indicated from the first, and with as little delay as possible. Each of the subdivisions, therefore, of this class, demands separate and careful consideration: but as they ultimately must require more or less protracted treatment, the same principles adopted for the first class will apply; and the third class ceases to be an injury of joint by immediate amputation.

In lacerated or incised wounds penetrating the capsule, it has been held matter of the highest importance to exclude the air, and secure, if possible, and by every means, union by the first intention. I have been led, by my observation of these injuries, to a conclusion not quite in accordance with this precept. Although it may safely be admitted as a general principle in surgery, that all wounds should be treated so as to procure the earliest possible union of their edges, this should be understood, in reference to wounds of joints, to apply only so far as the edges can be approximated without violence of any kind, constriction or pressure. I firmly believe that no pressure by bandages, compresses, or by means of strapping, can be applied in the first instance to injuries of joints, without doing mischief, and materially aggravating the inflammation, which, to some extent, must inevitably ensue.

I have found that cold, in the first instance, ap-

plied over the articulation, generally best assists in repressing and controlling the supervening inflammation, and if somewhat later it should become ungrateful to the patient's feelings, it may occasionally be exchanged, with advantage, for warm water dressings: or if the joint has assumed a puffy, swelled and unhealthy appearance,—a state often to be traced to the injudicious use of poultices,—a more tonic and stimulating mode of dressing will generally cause improvement. Of this kind of dressing, the best seem to me either a decoction of aromatic herbs, with the addition of a little wine, or warm camphorated or sweetened wine, which has not been freely adulterated with bad brandy, as are generally most of the wines consumed in England. Such dressing is not used in this country, but is frequently employed in the rest of Europe; and I have no hesitation in stating that I have seen the happiest effects from its use, when more emollient applications, such as poultices, certainly did not arrest, but, on the contrary, appeared to promote the '*engorgement*' of the limb. There is indeed a strong prejudice in this country against such applications, but founded upon theory rather than practice.

These means constantly require to be seconded by the most rigid antiphlogistic treatment—local and general bleeding, and particularly the application of leeches, in large numbers, to the articulation. The skin and the bowels should be made to act freely,

and the most absolute immobility of the joint secured.

The object of all treatment in these cases is very obvious. In the first place, we have to arrest and control inflammation, so as, if possible, to prevent suppuration. But it often happens that all our efforts fail, and inflammation goes on to suppuration. With this result the treatment changes, for its aim is no longer the same. The great object then is, firstly, to prevent the deposit and accumulation of matter in the articulation, which, notwithstanding all that has been said of its bland and innocuous nature, previously to the admission of atmospheric air, quickly erodes all the articulating surfaces, in the generality of cases; I have seen exceptions, but they are few; and secondly, to prevent the matter from burrowing among the muscles, extending upwards and downwards, thus involving the whole limb in a suppurative and disorganizing disease.

No sooner, therefore, is suppuration established, than it becomes necessary to devise the best means of obtaining its evacuation, and to secure its draining off, in proportion, or as fast, as it forms. Any fears of the contact of air I cannot but think are out of place. The matter will do more mischief by being allowed to lodge. Counter openings in pendent positions and free incisions, either in the vicinity, or if necessary, through the capsule, should be promptly and boldly practised, together with such regulated

pressure above and below the articulation, as the state of the limb may indicate and allow, in order to counteract the tendency to spread and burrow.

At the same time, the impression on the system, and the general health of the patient requires careful watching. Diarrhœa is of frequent occurrence, and difficult to check. If this be accompanied by hectic fever and great prostration of strength, and the appearances and state of the joint offer no prospect of speedy amelioration, it may become necessary, whatever the original injury may have been, to amputate as the sole chance of safety to the patient.

While the wounds are healing, and the discharge diminishing, the most perfect quiescence, I have taken care, should still be preserved, and for some time after cicatrization; gentle friction and passive motion may then be tried, very gradually. If the anchylosis resulting be partial, probably considerable motion may be recovered, and some force may be used; care being taken never to push these measures so far as to induce inflammation in structures still morbidly susceptible. If the anchylosis, on the contrary, be complete, no attempts of this nature should be made; a bony anchylosis often being the result of the diseased actions that follow a severe injury.

These observations comprise the general principles upon which all the cases included in the tabular Returns were treated. So far as they go, they are applicable to all kinds of wounds or lesions of the

articulations. The modifications that may be required by any peculiarity of injury, are by no means numerous, and generally sufficiently obvious.

The general results of the Tables may now be considered, and they will be most conveniently adverted to under the following heads:—

1. Their proportionate numbers, in relation to other classes of injuries, and of the articulations with each other.

2. Mortality, absolutely and relatively. Number of amputations to which these injuries give rise, and proportionate numbers in different periods.

3. Causes of mortality, with regard to the whole number of deaths, and to the number of deaths from each articulation, considered in relation to amputations at the three periods—primary, intermediary, and secondary, and to cases treated without amputation.

4. Influence of external and collateral circumstances.

1. *Proportionate Numbers, &c.*—These results will be found in Table II. Cases of severe joint injuries fix the attention, and make a stronger impression upon the memory, than many others of less interest, and, at the end of a few years, seem in much larger number than facts bear out. Certainly, had I stated the number according to my impressions only, of the cases of which I had made detailed notes, while under treatment, I should have been inclined to believe their proportion to the whole of the cases

which had fallen under my observation much greater.

Table II. furnishes an accurate statistical record of the whole number of injuries of the articulations, furnished by a series of actions in a little more than twelve consecutive months: it shows the proportionate number in about 1,800 wounded, officers and men, who were treated under my direction in that period.

The average may be stated, therefore, as between 4 and 5 per cent., or about $\frac{1}{21}$ of the whole number of 1,800 wounded; the injuries to the articulations counting 82. In a return already published* of wounded *men* admitted into the General Military Hospital of San Telmo, in thirteen months, amounting to 1,350, the average is less. In the returns of the different actions it varies from 1 in 30, to 1 in 52; but in these are not included many of the worst joint cases, amputated on the field, which appear in the return as "Field Amputations." I consider, therefore, the Return No. II., formed with the greatest care and accuracy, to give the true average. In the returns already quoted of 1,351 wounded, at San Telmo, the proportion of injuries of the head was 7 per cent.; wounds of the trunk, penetrating its cavities, between 4 and 5 per cent.; of fractures of the extremities, about 13 per cent., in which are

* "Notes on the Medical History and Statistics of the British Legion in Spain," 1838.

included the joint cases; of severe wounds not in these classes, 33 per cent.; of slight wounds about 44 per cent.

With respect to the relative numbers in the different articulations, of the 82 recorded, nearly one-half are of the knee.

Knee	35	proportion, 2·342		mortality,	22
Elbow	19	about	$\frac{1}{4}$		5
Shoulder	11	between	$\frac{1}{7}$ and $\frac{1}{8}$		3
Wrist	7		$\frac{1}{12}$		0
Ankle	6		$\frac{1}{15}$		1
Hip	4		$\frac{1}{20}$		3
Total	82			Total	34

2. *Mortality, absolute and relative.*—It required not less than the unanswerable evidence of figures to convince me the mortality was so great, remembering, as I did, many cases of successful result, even when unanticipated. I was scarcely prepared to find a loss of 34 in 82, including in the number treated those injuries which did not, in the first instance, implicate the structure of the joint, but only at some later period, by the progress of diseased actions spreading from the original site of injury. The number of cases in which the joint was primarily and directly implicated amounts to 65; 17 were only secondarily affected. Of the 65—

between $\frac{1}{5}$ and $\frac{1}{6}$, 12 were cured with more or less loss of motion and power, but all with some use of their limbs.

$\frac{1}{22}$, 3 intermediary* amputations were performed, and two patients died.

$\frac{1}{6}$, 11 secondary amputations; 5 deaths.

$\frac{1}{3}$, 21 primary amputations; 7 deaths.

Between $\frac{1}{5}$ and $\frac{1}{4}$, 18 died under treatment, while — the attempt was being made

Total 65 to save the limb, either in the hope of success, or, more frequently, from the patient's refusal to submit to amputation. The result, therefore, stands thus—

33 recovered; 21 with loss of limb;
32 died; 18 without amputation;
7 after primary amputation;
2 after intermediary;
5 after secondary.

Total 32

The mortality in the 3 classes stands thus, as regards the whole number of 65:—

* The term intermediary amputation refers to those performed between the third and twentieth days inclusive,—a period during which the febrile and inflammatory actions have commenced, rarely entirely subsided.

About	$\frac{1}{9}$, or 7	died after primary amputation;
	$\frac{1}{9}$, or 7	died after subsequent amputations;
Between $\frac{1}{8}$ and $\frac{1}{4}$, or	18	died during treatment without operation.
Total	32	

These are the positive results, according to the circumstances under which these series of cases were treated, rather than the relative results, or the necessary average mortality of a treatment uncontrolled by such events, or by the patient's will, and directed upon the best principles. It is quite evident that if the 18 cases of death without amputation, and the 14 cases of subsequent amputations,—(assuming them to be unfavourable cases for treatment in the first instance,)—instead of being treated, had immediately been amputated, we should then have had, for result, not a loss of 25, but of one-third, which is the loss from primary amputation: two-thirds, therefore, or 16 out of the 25, would have been saved.

As the tendency of many of the observations which follow is to lead to the saving of limbs rather than to their amputation, by defining cases in which operation, in the first instance, at least, may be judiciously avoided, I feel it the more incumbent to bring forward these general results in the clearest manner.

I will merely further observe here, that where the

joints were directly involved, the number *treated*, that is to say, in which primary amputation was not performed, amounting to 44, present a mortality of 25, considerably more than one-half, whereas the primary amputations cause a loss only of one-third, although naturally performed for the very worst injuries: and while 12 only were cured without loss of limb, 18 died in the vain attempt to save, without, for the most part, offering any fair opportunity of remedying the evil by intermediary or secondary amputation.

Of the intermediary and secondary amputations, where treatment failing to save the limb, amputation offered the only ground of hope for life, 7 died out of 14, amounting to one-half; but of the secondary amputations, properly so called, a fraction less than one-half were lost, 5 in 11. These cases form the forlorn hopes of surgery; all saved are snatched from nearly certain death.

The number lost among those who, notwithstanding the original object of cure failed, yet survived to a proper period, or otherwise gave an opportunity for amputation, is small in relation to 44; the deaths only amount to 7 of those primarily involved, or one-sixth; but to these should be added the 18 deaths during fruitless treatment, and the total loss should be estimated against the one-third dying from primary amputation. This is the only true mode of testing the comparative mortality.

The following are the results of the 17 cases secondarily implicated:—

13 recovered, the greater part with some injury to power, sensation, or motion, but none with useless limbs.
2 died under treatment.
2 underwent amputation; 1 intermediary, 1 secondary, and both recovered.

Resumé.

15 saved, 2 with loss of limb.
2 died under treatment.

Finally, including both classes of injuries, i. e. those directly, and those only secondarily implicating the articulation, the 82 classified in Return II. give for result—

25 cured without amputation;
23 cured with loss of limb, 14 after primary, 2 after intermediary, and 7 after secondary amputation.
48 Total.

7 died after primary amputation;
2 died after intermediary ditto;
5 died after secondary ditto;
20 died under treatment, and without amputation.
34 Total.

In reference to the injured articulations, which lead to fatal terminations, much depends upon certain classes of mechanical or physical causes. 1stly. Upon the degree and nature of the injury;

2ndly. The extent of articulating surface implicated, and consequently the site; and 3rdly. The favourable or unfavourable nature of external circumstances. These all exercise a strong and abiding influence, as will shortly be shown.

The hip is more rarely the seat of direct injury from foreign bodies than any of the articulations. The result is generally fatal; three in four died; and in the fourth, where recovery took place, the joint itself, there is some reason to suspect, was but remotely affected.

The shoulder is rarely implicated directly by injury without a subsequent operation, amputation, or excision of the head of the humerus, being required. In 11, which occurred in the series of 82, only 2 were cured without amputation; 7 amputations were performed, 6 primary, and 1 intermediary; the latter was unfortunate in its result; all the primary recovered.

By operation, therefore, they do not form so fatal a set of cases as has generally been imagined. In 9 primary amputations, in Return No. I, there was one death; and this operation was performed under very unfavourable circumstances, and the patient subsequently retained in a crowded hospital, with a typhoid fever prevailing. I am inclined to estimate them as a more favourable class of cases than any injuries leading to amputation above the knee.

The injuries of the knee are the most numerous, and with the exception of the hip, the most fatal to life, and generally, at best, leading to the loss of limb:

of 35 of the knee (see Return No. II.), 22 lost their lives, and of the remaining 13 who were saved, 8 lost their legs. After such results, it is little to say that the 5 who recovered preserved good and useful limbs.

The primary amputations (see Table I.) amount to 9, and 4 died: they are decidedly more trying injuries to the system than those of the shoulder, not only by the double shock being greater, as proved by this result, but by the gravity of the actions, to which the original injury gives rise. Thus there were 3 intermediate amputations, and 9 secondary, and only 4 recovered out of the 12, or one-third, two-thirds dying.

Injuries of the elbow stand next in order of frequency, making a total of 19 cases, 5 of which were fatal; 10 were cured without loss of limb, but nearly all with anchylosis, complete or partial; 1 died during the attempt to save the limb, at the 120th day, of angina pectoris; 4 out of 7 primary amputations died, all with disease of chest or liver; 1 secondary amputation recovered.

Deaths, in secondary amputations for injuries of the elbow, are rarely to be anticipated. The cases have not generally deeply implicated the system, or irreparably injured the constitution. The portion of the body removed is small; the shock of the operation, when not superadded to another immediately preceding, but trifling. Nothing, therefore, but some of the accidental complications, occasionally

supervening in all amputations, are to be looked for as probable causes of death.

The ankle is less frequently directly implicated in serious injury than might be expected. Generally, the violence is first received on some part of the leg, which breaks; thus often saving the articulation below.

In the series of 82, there are but 6 cases; 1 died, and that from effusion into the serous cavities, anasarca, the limb erysipelatous and gangrenous; 3 required amputation, 1 primary, 2 intermediary,—all recovered.

The wrist is, upon the whole, more frequently injured, but in no proportion to the knee, and much less often than the elbow or shoulder. In 7 cases included in the series of 82, all recovered; 1 after secondary amputation.

Although gun-shot fractures of the bones of the hands and feet, for the most part, more or less involve some of the lesser articulations of the phalanges or metacarpus, I have not included any of these cases in the returns of joint injuries: they, in fact, more properly belong to fractures simply. It is surprising, moreover, how often both hands and feet undergo severe injuries, without any direct or serious implications of the articulating surfaces.

In reference to this part of the subject, I may also remark, it should not be lightly presumed, that because a severe injury is inflicted in the immediate vicinity, and the bone even comminuted, that the articulation is either directly, or will of necessity, be

subsequently involved, or, at least, to any dangerous extent. Many cases have come under my care in which excellent and useful limbs have been saved under such circumstances.

I made careful notes of three cases of the wrist, in two of which the radius was broken into fragments, within half an inch of the carpal articulating surface, and yet the joint seemed to escape. In two cases, also, of the knee, in one of which a ball lodged six months in the head of the tibia, immediately beneath the articulation,* without involving it, and another,† where the femur, close to the condyles, had many fragments struck from it, merely causing two or three hair-like fissures into the articulating surfaces. The leg, in this case, was amputated with my concurrence, taking into consideration the extensive laceration of soft parts, probable injury to the popliteal blood-vessels, &c. But, as regards the *injury to the articulation*, it will be evident that the limb, in all probability, might have been saved. This is a case that I have classed among those not necessarily indicating primary amputation.

* In a paper of Dr. Holmes, Assistant Surgeon to the Forces in Canada, published in the Edinburgh Medical and Surgical Journal, July 1840, a case is related where a ball fractured the fibula, and passed through the head of the tibia, without fracture or fissure, involving the joint; and at the end of five weeks, when amputation was performed, to arrest the irritative fever, &c., no inflammation had taken place in the joint.

† The preparation was shown.

In another case of a wound of the elbow, in which a ball passed through the bend of the arm, traversing the exterior of the capsule, although the arm was the subject of secondary amputation for the surrounding disease, the joint itself was found free from any affection. In two cases, also, of the foot, although balls partially traversed the bones of the tarsus and metatarsus, no violent, or, as far as could be determined, no articular mischief of any kind ensued.

3. *Causes of death.*—The causes of mortality in severe injuries to the articulations afford much scope for inquiry; and questions of great interest and practical importance arise from it. The Return No. I, gives a total of forty-three fatal cases,—a fair number for consideration. They may be advantageously classed under four heads:—

1.	23	died under treatment for the original injury.
2.	4	— after intermediary amputation.
3.	5	— after secondary amputation.
4.	11	— after primary amputation.
	43	Total.

If there be any one obvious cause prevailing in many, we may fairly presume that it forms a leading feature of danger in all such injuries. Thus I found in the twenty-three not less than

11 died of a wasting discharge and febrile action —hectic fever chiefly; the demands on the constitution great; the diseased action unconquered; disease from 8 to 72 days' duration;
2 with chronic tetanus, and one of these accompanied by hectic fever, the other by organic disease, namely, congestion of lungs, and abscesses of the left lobe of the liver;
1 from mortification;
1 delirium tremens;
1 with secondary hæmorrhage;
2 one with effusion into the serous cavities, and the other angina pectoris, both chest affections;
2 from the effects of other grave injuries;
1 from shock;
2 from causes not known.

23 Total.

One-half died with wasting discharge and febrile action—hectic chiefly.

One-half died from supervening irregular actions, such as mortification, delirium tremens, tetanus, affections of chest complicating the hectic state,—from accidental occurrences, such as secondary hæmorrhage, and from other complicating wounds.

It does not seem that there is any peculiar tendency to the formation of purulent diseases in other organs or parts of the body,—an opinion I was in-

clined to entertain, until a more enlarged experience and a close analysis of a considerable number, proved to me that such cases were few, and probably not in any degree distinctive or peculiarly depending upon injuries of the articulation. They occur in gun-shot fractures into joints, and in fractures totally apart, nearly in the same proportion. Of twenty-two deaths from these injuries, but three give any affection of distant organs,—one angina pectoris, one effusion into serous cavities, one congestion of lungs and abscesses of left lobe of liver.

In nineteen deaths occurring in the treatment of fractures not implicating joints, three cases of purulent disease of lungs or liver were traced, and a fourth was suspected, but the cavities of the thorax and abdomen were not examined.

If we proceed, however, to consider the causes of death in the amputations, primary and secondary, performed for these injuries of joints, the cases alluded to become of much more frequent occurrence, but still, the comparison of results with merely gun-shot fractures, saves me from the error of attributing this cause of mortality to injuries of articulations especially or solely.

In the injuries of the articulations for which amputation was performed, there were twenty deaths; and in seven the chief cause appeared, after death, to be purulent diseases in distant parts.

In gun-shot fractures not connected with the joints, the number of deaths after amputation was thirty-five. In eleven, the same effects were ob-

served; one was of doubtful character, the cavity not having been examined; and two had pus in the blood-vessels, one in the femoral vein and artery, the other in the femoral vein alone.

Does this result depend upon the original injury? or is it to be considered as an effect of the amputation? The larger number after amputation must prove that the operation has a powerful influence, while the occurrence of precisely the same results in both sets of cases, in which no operation was performed, equally proves that amputation is, at least, not the only cause. Since both the injury and the amputation are each followed by these results, although in very different proportions, it seems most probable that in the greater numbers presented by amputations, the two shocks of the injury and the operation combine to produce this fatal effect.

This view is borne out by the fact, that such causes of death occur in the great majority after *primary* amputations, and not after those performed in subsequent periods, least of all in the secondary period.

In the injuries of the articulations, only one occurred after intermediate, and none after secondary amputation; and in fractures only two cases, in like manner, after intermediate amputation. Thus the operations of the period nearest to the primary are the only ones that are followed by these peculiar effects in the series under consideration.

I dwell the more upon this point, because it is in direct contradiction to some few facts, and an ingenious theory, brought forward by Mr. Guthrie and others, in years past. By their influence they have gone far to establish the belief that these purulent diseases in distant organs are distinctive of *secondary* amputations, and such diseases have been added, accordingly, to the dangers and evils peculiar to those operations. This is a view entirely opposed to all the facts I have observed in relation to this subject. It is one of great importance, and calculated, I must believe, to lead to a conclusion so erroneous in its bearing upon the question of primary and secondary amputation, that I have felt it incumbent upon me thus distinctly to state the result of my observations.

In some investigations, made with a view to determine the effects of operations, and especially of amputations, on the system, I was led to the conclusion that the *nature* as well as the *extent* of the original shock or injury might exercise considerable influence. In such an inquiry, injuries of joints, of course, form only a small section of the subject. At some future period I hope to have the honour of submitting my views on this question in its whole bearing; but at present I merely advert to it, in reference to the predominating causes, influencing the progress and terminations of cases of joints without amputation, and after amputation, practised at different periods.

To follow out this object, the following analysis will materially assist :—

Resumé of the causes of death in the four classes. 1. Without operation; 2. After primary amputation; 3. After intermediary; 4. After secondary amputations.

In the first class of 23, *dying while under treatment for the original injury,*

3 died with affections of the lungs and pleura;

11 or one-half, died with wasting discharge and febrile action—hectic chiefly;

9 or the remainder, by accidental or irregular complicating actions which supervened.

In the second class of 11, *dying after primary amputation,*

6 more than half, died of diseases of lungs and liver (with one exception,) of suppurative and purulent character;

4 died of febrile action, chiefly irritative, 1 bilio-remittent, a species of yellow fever;

1 of accidental complication, with cholera.

In the third class of 4, *intermediary amputations,*

3 febrile—1 bilio-remittent, 1 in which the shock of the injury never disappeared, 1 with a single tubercle and a small isolated purulent deposit in the lung;

1 accidental—secondary hæmorrhage and phlebitis.

In the fourth class of 5, *secondary amputations,*

2 from shock of operation, exhausted, on second and fifth days after;

2 hectic—1 complicated with erysipelas and diarrhœa;

1 accidental—secondary hæmorrhage.

The legitimate conclusion from this analysis and *resumé* shows, that the chief danger and cause of death in cases treated to the end without operation, is hectic fever; and a variety of accidental or irregular complications, such as secondary hæmorrhage, epidemics, erysipelas, gangrene, &c., combined, form the remaining half.

The cases in which amputation is performed in the first instance, with fatal result, present a very different cause of mortality: the chief agent being purulent disease of lungs or liver, and occasionally inflammatory affections of the lungs or pleura. Fevers irritative or bilious destroy more than one-third.

The deaths after intermediary amputations are chiefly caused by febrile action, irritative or bilious; and in secondary amputations, the shock of the operations, hectic, and some accidental complications carry off the patients, already much reduced by suffering and the long continuance of wasting discharges. The results of secondary amputations, when fatal, and their causes of mortality, are in some degree assimilated to those predominant in cases treated to the end without operation.

Before I conclude the subject of mortality in these injuries, and their leading causes, I must briefly advert to the influence of external and collateral circumstances upon the progress and termination of cases treated and amputated, in proportion as those circumstances are favourable or otherwise. Under this head come the injurious effect of long transport, deficient means of treatment, bad locality, crowded or temporary hospitals, prevailing epidemics, climate, &c.

RETURN, No. III.—*Results of Injuries to Joints in cases Amputated, or treated without Operation, under* favourable *Circumstances. Including a Period of about Thirteen Months.*

Joint implicated.	Results of Amputations.												Cases not amputated.									TOTAL.		
	Number of Cases.				Cured.				Died.				Number of Cases.			Cured.			Died.					
	Primary.	Intermediary.	Secondary.	Total.	Primary.	Intermediary.	Secondary.	Total.	Primary.	Intermediary.	Secondary.	Total.	Joints primarily involved.	Secondarily involved.	Total.	Primar. Inv.	Second. Inv.	Total.	Primar. Inv.	Second. Inv.	Total.	Cured.	Died.	Total.
HIP . Musket														2	2		1	1		1	1	1	1	2
KNEE . Cannon																								
KNEE . Musket	4		6	10	3		3	6	1		3	4	5	3	8	1	3	4	4		4	10	8	18
ANKLE . Cannon			1	1			1	1														1		1
ANKLE . Musket		1		1		1		1						1	1		1	1				2		2
SHOULDER . Cannon													1		1				1		1		1	1
SHOULDER . Musket	2			2	2			2														2		2
ELBOW . Cannon	1			1	1			1														1		1
ELBOW . Musket	2		1	3	2		1	3					3	5	8	3	5	8				11		11
WRIST . Cannon																								
WRIST . Musket			1	1			1	1					2	2	4	2	2	4				5		5
Total .	9	1	9	19	8	1	6	15	1		3	4	11	13	24	6	12	18	5	1	6	33	10	43

RETURN, No. IV.—*Results of Injuries to Joints in cases Amputated, or treated without Operation, under Circumstances* partially unfavourable. *Including a Period of about Thirteen Months.*

Joint injured.	Results of Amputations.												Cases not Amputated.									TOTAL.		
	Number of Cases.				Cured.				Died.				Number of Cases.			Cured.			Died.					
	Primary.	Intermediary.	Secondary.	Total.	Primary.	Intermediary.	Secondary.	Total.	Primary.	Intermediary.	Secondary.	Total.	Joints primarily involved.	Joints secondarily involved.	Total.	Primar. Inv.	Second. Inv.	Total.	Primar. Inv.	Second. Inv.	Total.	Cured.	Died.	Total.
HIP . . Musket													2		2				2		2		2	2
ANKLE Cannon		1		1		1		1														1		1
ANKLE Musket													1		1				1		1		1	1
SHOULDER . Cannon	1			1	1			1														1		1
SHOULDER . Musket	2			2	2			2					1		1				1		1	2	1	3
KNEE . . Musket			1	1			1	1					2	1	3	1		1	1	1	2	2	2	4
ELBOW . Musket													2		2	1		1	1		1	1	1	2
WRIST . Musket													1		1	1		1				1		1
Total .	3	1	1	5	3	1	1	5					9	1	10	3		3	6	1	7	8	7	15

RETURN, No. V.—*Result of Injuries to Joints in cases Ampu-*
Including a Period of

Joint injured.	Results of Amputations.											
	Number of Cases.				Cured.				Died.			
	Primary.	Intermediary.	Secondary.	Total.	Primary.	Intermediary.	Secondary.	Total.	Primary.	Intermediary.	Secondary.	Total.
KNEE . . . . Musket	3	1	2	6	1			1	2	1	2	5
ANKLE . . . . Cannon	1			1	1			1				
ANKLE . . . . Musket												
SHOULDER . . . . Musket	1	1		2	1			1		1		1
ELBOW . . . . Musket	4			4					4			4
WRIST . . . . Musket												
Total . .	9	2	2	13	3			3	6	2	2	10
Total partially unfavourable . .	3	1	1	5	3	1	1	5				
Total favourable	9	1	9	19	8	1	6	15	1		3	4
JOINT TOTALS . .	21	4	12	37	14	2	7	23	7	2	5	14

4. *Influence of External and Collateral Circumstances.* —Returns III. IV. and V. have been framed for the purpose of showing, at one view, the relative numbers and mortality, under three classes of circumstances, which I would define as follows :—

1. *Favourable circumstances.* Cases admitted into a large, well-organised, and commodious hospital, an hour or two after the injury was inflicted, and there treated, to the end, under the same medical superintendence, and with all essential means for good treatment.

2. *Partially unfavourable circumstances.* Cases not immediately received into a well-organized hos-

tated, or treated without Operation, under Circumstances unfavourable. *about Thirteen Months.*

Of Cases not Amputated.									TOTAL.			
Number of Cases.			Cured.			Died.						
Joints primarily involved.	Joints secondarily involved.	Total.	Primar. Inv.	Second. Inv.	Total.	Primar. Inv.	Second. Inv.	Total.	Cured.	Died.	Total.	
7		7				7		7	1	12	13	
									1		1	
1	1	2	1	1	2				3	1	4	
1		1	1		1				1	4	5	
1		1	1		1				1		1	
10	1	11	3	1	4	7		7	7	17	24	Mortality about two-thirds.
9	1	10	3		3	6	1	7	8	7	15	Mortality one-half.
11	13	24	6	12	18	5	1	6	33	10	43	Mortality not a fourth.
30	15	45	12	13	25	18	2	20	48	34	82	Mortality about two-fifths, or 1 in 2·411.

pital, subjected to some leagues of transport, or passing part of the first period in a field hospital, with deficient means, or received into a permanent hospital, with a lax discipline.

3. *Unfavourable circumstances.* Cases admitted into crowded hospitals with epidemics prevailing, means, either personal or material, not fully adequate; with cases of wounds inflicted after a reverse in the field, or long subjected to the deficient means, discomforts, and imperfect discipline of temporary or field hospitals, with one or two days' subsequent transport to the permanent hospital stations.

It will be seen that *under favourable circumstances*

the mortality in amputations is little more than one-fifth, or 4 in 19.

In cases not amputated, exactly one-fourth, or 6 in 24.

In primary amputations, taken separately, there is a loss of only 1 in 12, if we take the amputations in No. I., 5 of which are above the knee, and 4 at the shoulder joint.

In the two classes combined, cases treated and cases amputated, (see Return No. III.) the mortality is between one-fourth and one-fifth, or 10 in 43.

Under Circumstances partially Unfavourable.

There are only 5 amputations, and these all recovered, although 3 of the shoulder-joint and 1 of the thigh.

In cases not amputated, the mortality is 7 in 10, about two-thirds.

Mortality in the two classes combined is 7 in 15, one-half.

Under Unfavourable Circumstances.

The mortality in amputations (see Table I.) is about $\frac{7}{9}$, or 15 in 19.

In cases not amputated (see No. V.), it is $\frac{7}{11}$, or 7 in 11.

The two classes combined give a mortality (Table I.) of more than two-thirds, or 22 in 30.

No. I. has been occasionally referred to for the average on amputations, because it gives a larger number; and as they form a complete set, i. e. they

include all the amputations performed for these injuries in the periods embraced, they do not lead to any inaccuracy of conclusion. The average founded on a larger number gives, of course, a fairer test; and the cases treated and amputated may thus be made equal in numbers: the amputations being 49, the cases not operated upon 50. There is scarcely a variation, however, in the relative mortality of the Tables.

The evidence of these statistical results is too striking to leave any doubt whatever as to the influence which these circumstances exercise, totally independent of the constitution of the patient and the degree of injury.

The influence on the number of amputations performed at the three different periods is also a subject of interest. See Returns III. IV. V.

	Primary.	Intermediary.	Secondary.	Total Number Treated.
Under favourable circumstances . . .	9	1	9	43
Under partially unfavourable . . .	3	1	1	15
Under unfavourable .	9	2	2	24
	21	4	12	82

Under favourable circumstances, the total number of amputations is less than one-half, nearly equally divided between the two periods of *selection*, primary and secondary. In partially unfavourable circumstances, one-fifth, *chiefly primary*; under unfavour-

able circumstances, above one-half, more than two-thirds being primary.

The proportion of amputations performed under favourable, compared with those under unfavourable circumstances, in reference to the number treated, shows the influence of these circumstances, over which the surgeon has no control, to fall chiefly upon the periods of amputation and their mortality, not upon the absolute number performed.

In favourable circumstances	19 amputations	are performed in	43 cases, less than one-half;	mortality on number treated 10
In more or less unfavourable	18 do.	in	39 cases, less than one half also, there being only a fractional difference between the two.	do. . . 24
	37		82	34

(See Table II.)

In each, as in the whole, the number performed is a fraction under the half; but a small fraction of cases reaching the period for secondary amputation under unfavourable circumstances.

So, in the causes of mortality, there is no difference in the actions producing death, under these varying circumstances, sufficiently distinctive to merit especial observation. The influence here seems expended on the *number* and *severity* rather than on the *character* of the actions, which, if rendered more frequent and more fatal, are not essentially different in nature. The mere enumeration of the diseased actions to which death seemed chiefly attributable will suffice for all material purposes; the cause of death has been determined (in a small number of the cases) without examination of the cavities after death. The deaths, amounting to 34, are thus divided:

Seven under Partially Unfavourable Circumstances. No Deaths after Amputation.

2 diarrhœa and hectic.
2 diseases of chest.
2 exhausted; 1 with large abscesses, and 1 with sloughs on back.
1 fever and profuse suppuration, with great disease of whole lower extremities.

7

Seventeen under Circumstances Unfavourable. Ten after Amputation.

2 complicated, with wounds of chest and shoulder; 1 attacked by bilious remittent after amputation (intermediary).
12 febrile actions, variously complicated. Hectic in 3; irritative in 3; bilio-remittent in 4; fever of no very distinctive character in 2. Included in these are 5 cases of diseased lungs or liver, (by purulent deposits,) in all except 1, and in 2 of these phlebitis also, and 2 where the shock of amputations played a prominent part.
1 tetanus.
1 great and destructive disease of joint existing; no other obvious cause of death.
2 cause not known; notes of post mortem mislaid.

17

Ten under Favourable Circumstances.

Amputations:

2 secondary hæmorrhage; 1 secondary amputation, and 1 primary.
1 disease of lungs and liver.
1 shock of injury, first day (cannon shot).
1 erysipelas and diarrhœa, secondary amputation.

Not amputated:

1 gangrene.
2 exhaustion, with sloughing action in one; cavities not examined.
2 fever; 1 intermittent; 1 hectic, with diarrhœa.

10

With this review of the general results, I take leave of the tabular returns, and the statistics of injuries of joints, to proceed to the last division of the subject—the classification of particular kinds of injuries, in reference to the leading principles of treatment for each.

When injuries implicate directly the structures entering into the formation of a joint, it becomes an object of the greatest importance to determine, firstly, the character and extent of the lesion; and, secondly, whether such mischief will ensue as shall render the attempt to save a limb not only abortive, but dangerous to life in the period of probation.

I think experience may be brought to bear in such an unequivocal manner as to supply that which

is much wanted, viz. *a definition of those kinds of direct injury, in which we shall be justified in making the endeavour to save a moderately useful limb;* justified by the actual success of a few, and by the opportunity not failing, in the majority of those in which this object is not attained, for arresting unfavourable diseased actions by secondary amputation.

THIRD PART.

CLASSIFICATION OF KINDS OF INJURY IN WOUNDS OF THE ARTICULATIONS.

With a view to furnish data upon this part of the subject, I shall very briefly refer to some important cases which have fallen under my own care, and may be taken as types of a class, giving, however, only such description of the injury and result as may be essential to the appreciation of their bearing on the conclusions for which they form the grounds. On the treatment it does not seem necessary to dwell, after the explanation of the general principles which I consider applicable.

CASE I.

Extensive fissure into the ankle joint, from a comminuted gun-shot fracture of the bones above.* The

* The preparation was among the specimens shown.

patient lived during several months, and although the joint was not found healthy, yet no active or destructive disease had been developed. He died with an erysipelatous and gangrenous leg, effusion in the serous cavities, and general anasarca.

CASE II.

Bears analogy with the first, at the same time that it furnishes an example of another class or kind of injury. A sailor of a man-of-war steamer, in 1836, received a musket shot while rowing a boat employed in the disembarkation of troops. He was immediately forwarded to one of the hospitals, under my direction, in San Sebastian. Although there was every reason to believe that the ball had lodged in the cancellated structure of the femur, yet from the absence of any detached portion of bone, or rough fracture in the articulating surface of the bone, so far as I could ascertain, I felt warranted in an endeavour to save the limb.

In a few weeks the wound healed, and the knee, to all appearance, was undiseased; the patient only complaining of some weakness and difficulty in walking, with occasional pain; he was invalided home.

Three months ago he came to me, with a request that I would amputate his leg, for that, to use his own expression, "it so bothered him" in walking, and gave him occasionally such acute pain, that he

would infinitely rather stump about on a leg of wood. Not being attached to any metropolitan hospital, I sent him down to the Westminster, to my friend, Mr. Guthrie, who removed the leg, which, externally, presented a cicatrix, but no other mark of injury or disease, past or present.

The ball was found to have passed through the internal condyle, and presented a somewhat flattened, yet convex, smooth surface, on a level with the articulating surface, resembling a piece of metal let in. It had fissured the bone (as may be seen in a very slight and hasty sketch I made at the time),* and this fissure *had been nearly entirely filled up with osseous matter*. In four years the only mischief done to the joint was some thickening of synovial membrane, and a partial absorption of cartilages.

No very active, acute, or destructive disease had been developed, either at the time of the accident or since.

CASE III.

Has furnished the finest preparation in my collection, and requires notice here, because it presents an injury apparently similar to the last, with a very different result, depending upon an essential difference in the injury, although one easily overlooked. I need merely state, that it shows a ball lodged, somewhat rough, and slightly projecting beyond the level of the articulating surface of the femur. In

* The sketch was shown.

twenty-seven days, it produced a total destruction of all the structures of the articulation.

From these facts, which I do not think it necessary to multiply by cases of a similar type, I have drawn the following conclusions, forming the first step in classification.

1. A mere fissure of a joint, extending from a fracture, partial or complete, is not necessarily followed by severe, extensive, or destructive action in the structures of the articulation. If any other attendant circumstances, therefore, do not forbid, the attempt may be made to save the limb, with a fair prospect of a favourable result.

2. A foreign body, a musket-ball, for example, lodged either in the cancellated structure of the tibia or femur, may or may not penetrate the articulating surface, or project beyond it.

If it do not penetrate to the articular surface, it does not *necessarily* implicate the joint, or lead to any diseased action therein, and may at some later period be removed, if that be not possible at the time. If it do penetrate, but be smooth in surface, and not projecting beyond the level of the articulating surface, the same rule holds good, viz., that violent diseased action is by no means a necessary consequence, and I have been led to believe that in such a case, anchylosis, and a useful limb may, in many instances, be the result of careful treatment.

If the missile project, or if it be roughened, or cause any jagged projection of bone, the most destructive and rapid disease of the whole articulation

follows, and in the knee especially, will inevitably lead either to amputation or death. In the elbow I have known such a case saved; in the knee never.

The following is the line of practice, therefore, which it seems to me should be acted upon. When any foreign body has penetrated the end of a bone forming an articulation, the surgeon should endeavour, by finger or probe, to obtain an accurate knowledge of its position. If he concludes, after such examination, that there is no projection into the articular surface, and it cannot be removed without great additional violence to the parts, such as burying the head of the trephine deep in the spongy end of a bone, the attempt should not be made, but the limb may be treated with a view to saving it. If we fail in this, a period will probably arise favourable to the performance of secondary amputation, and to its successful issue. If the ball has, on the contrary, penetrated into the joint, fracturing its way, and remaining either fixed or loose in the articulation, there is only one chance of safety for the patient's life, and none for the limb. Immediate amputation I believe to be the best and only judicious practice. The next series of cases leads to the consideration of another class of these injuries.

CASE IV.

During an action, in the beginning of 1836, on the heights of Arlaban, seeing that one of the men, whom his comrades were removing from the spot

where he had just fallen, was wounded in the knee, I dismounted, to examine the nature of the injury, warned by frequent past experience of the value of the first half hour, before the limb has become swollen, tense and painful.

The ball had entered at the edge of the patella, and passed through the internal condyle of the femur, emerging in the popliteal space. Neither swelling nor inflammation having had time to come on, my finger easily followed the course taken, and I immediately decided on the propriety of attempting to save the limb, since I ascertained, to my satisfaction, that the ball had only forced a passage through, without breaking off any detached fragment of bone in the articulation.

The limb was lightly dressed, and he was then dispatched to the rear. At night, one of the regimental surgeons, quartered with his men in the same village with myself, came to request I would see a wounded man, whose leg, he thought, should be removed without delay.

On arriving, I recognised the patient as the man already seen. The limb was now swelled, and so greatly inflamed, that examination was no longer possible; and had I not previously satisfied myself, very fortunately, of the exact nature of the injury, I probably should have taken the same view as my colleague, looking to the direction of the shot holes, and condemned the limb.

The next day, I had the wounded removed a few leagues to Vittoria, and took good care of him. He

perfectly recovered, and with such excellent use of the limb, that he lately walked from Liverpool to London.* A similar case occurred the following year, and with an equally favourable result.†

CASES V. and VI.

Are similar injuries, except in degree, causing greater mischief, and a less favourable termination.‡

In *Case V.* the ball passed through the tibia, a little below, and to the inner side of the head of the fibula, and several portions of the external table may be observed driven inwards into the spongy structure. The ball made its exit a little above, and external to, the tuberosity of the tibia. The patient died on the forty-eighth day. The joint was found filled with unhealthy pus, communicating with a

* He was present, and many of the Fellows of the Society examined the state of the leg.

† John Hunter relates a parallel case of recovery, where the man had no medical attendance whatever the first four days. A somewhat similar case has lately been recorded by Dr. W. Home, Assistant-surgeon to the Forces in Canada: it is published in the last number of the Edinburgh Medical and Surgical Journal for July 1840.

The ball entered low down in the thigh, shattered the external condyle—(I presume without detaching fragments into the articulation),—traversed the joint, and passed out between the internal condyle, and the head of the tibia: the symptoms, local and constitutional, were very severe, but, after the separation of several pieces of bone, a cure by anchylosis was finally effected.

‡ The preparations were shown to the Society.

large abscess in the leg, the whole limb infiltrated. Nevertheless, the structure of the joint was unchanged, *except in the synovial membrane, which was thickened.* The man had long laboured under chronic tetanus. The lungs were congested, the surface of the liver lobulated, and several small cavities were found, more particularly in the left lobe.*

Case VI. is of a similar kind, a musket ball having passed through the humerus, between the condyles; the result was a bony anchylosis, and such a diseased state of bone, and soft parts, as led to secondary amputation, from which the patient recovered.

These and similar facts have suggested the following conclusion :—

When the end of a bone, entering into an articu-

* Another case, related in the last Edinburgh Medical and Surgical Journal, by Dr. Home, as lately occurring in Canada, shows the necessity of care and caution in assuming perfect similarity throughout, in seemingly parallel cases, and indeed the impossibility of prognosticating with certainty the effects that will ensue even on any well-ascertained parity of character, or extent of injury.

He relates, that a ball passed through the head of the tibia, having first fractured the fibula, an inch below its head. The patient seemed in danger of sinking from irritative fever and exhaustion, and at the end of the fifth week, amputation was performed: *it was found that no fracture had extended into the joint, nor was there any articular inflammation.* He recovered after amputation.

Many apparently similar injuries have fallen under my notice, where fissuring fractures projected into the articulation of the knee, leading to the rapid development of the most destructive actions.

lation is traversed by any foreign body or missile, more especially if it pass between the condyles of the femur or humerus, even though the integrity of the capsule, at one or more points, should be injured, if there be no detached fragment of bone, the joint, in many cases, may be saved; and the attempt may generally with propriety be made, when no other injury or unfavourable circumstance is superadded.

CASE VII.

Brings under notice a class of injuries affecting the capsule only, or that chiefly.

Captain B., wounded in the knee at the assault of Irun, May 1837, had been conveyed across the frontier into Behobia. Amputation had been decided upon as the only resource, but the operation was deferred until the place was carried, and my duties there, as chief medical officer, allowed me to leave the scene of action to see him.

I found a musket-ball had entered at the upper and outside of the patella, and passing obliquely downwards, traversed the joint, lodging, I believe, in the neighbourhood of the joint. Although the medical officer who first saw him thought he felt it detached within the capsule, I could not, however, trace it, and my impression was that it had lodged beyond the capsule.

The swelling and inflammation supervened more slowly than usual, and I was enabled, with my finger, carefully to follow the track of the ball, between the articulating surfaces of the patella, femur, and tibia.

I could ascertain neither fissure nor fracture, and finally came to the conclusion, that the ball opening the capsular ligament had coursed obliquely across the articulation, between the surfaces of the bones, without *materially* injuring their structure. Under these circumstances, I conceived the hope of saving the limb, and so decided.

The patient recovered completely; and so good and useful a leg is the result, that the British Army Medical Board did not conceive the permanent results warranted their recommending him for a pension; although, I believe, he thinks himself inadequately compensated, and complains of frequent pain in the limb, he certainly walks well, and without apparent lameness.

Upon cases of this class I have drawn the following conclusion. Wounds of the capsule, and even the traversing a joint by some missile or weapon, provided neither bone nor cartilage be seriously injured, do not require or justify amputation as a first remedy. The majority may be saved, even should the motion of the joint be more or less impaired; a useful limb may still be preserved.

Contrary to the general impression, I am strongly inclined to the conclusion, that injuries to joints are not fatal in proportion to the extent of surface laid open. The most dangerous of these wounds I believe to be punctured, or such wounds as a musket-ball creates,—a small, lacerated, and contused opening, with more or less mischief to the internal parts. The most violent inflammatory action ensues in the

highly susceptible synovial membrane, which, for a certain period, or until disorganization (the result of violent action) takes place, still retains its distinctive characters of serous or synovial membrane. Fluid is effused and pent up—the whole limb becomes involved—the system takes the alarm, and sympathises often to a fatal extent. No kindly suppurative and granulating action takes place over the surface of the synovial membrane, altering its characters and susceptibility,—a result which follows not unfrequently in a wound laying a joint fairly open, quickly destroying, of course, the texture and character of synovial membrane, and leaving anchylosis as the only favourable result possible. But under such injuries, this is the happiest result we can ever look for; and the patient who so escapes has reason to be well satisfied that he has lost only the motion of a joint instead of a limb, or his life, or, as frequently must happen, the one first, and the other afterwards.*

* In No. X. of the Guy's Hospital Reports, the history of a gun-shot wound is given, which was under the care of Mr. Ward, of Huntingdon. The knee-joint was laid open by the contents of a fowling-piece, and a great portion of the patella shot away. A poultice was applied, *and no unfavourable symptoms*, either local or constitutional, occurred during the progress of the case. The remaining small portion of patella was subsequently removed. In three months the wound healed.

Eventually, considerable motion of joint was gained; the cicatrix, by its firmness or cartilaginous structure, seems to have supplied the place of the patella, and the patient is reported to walk well without a stick.

This is certainly the most extraordinary case, taken in all its

CASE VIII.

A complicated case of injury to the knee, painful and embarrassing in its circumstances, and rapidly fatal in its result, occurred, a few months ago, to a young gentleman, in leaping a railing, consisting of parallel bars. His foot caught, and his body was precipitated over, while he hung, with his leg engaged between the bars, for some seconds, before he could be disengaged.

The accident happened about five o'clock afternoon, some miles from town, where he remained. The knee was partially dislocated, but speedily reduced by a practitioner on the spot. There was evident mischief to the popliteal vessel or vessels, and great extravasation, which was checked by the application of a tourniquet.

At twelve o'clock at night, I was asked to see him in consultation. My friend, Mr. Solly, his usual medical attendant, had arrived before the messenger set off, and another eminent surgeon was each moment expected. Seeing, therefore, that any measures they might think necessary would probably have been taken before I could reach, I did not see him that evening, nor until the second day after the injury. The

features, that I have met with on record. Mr. Bransby Cooper observes, that the synovial membrane in large wounds speedily loses its distinctive character; the great shock of the injury tending also to prevent inflammation. In punctured wounds, he adds, the matter is pent up, and the synovial membrane is excited to violent inflammation: thus closely corresponding with the opinion I have given.

femoral artery, at the upper third of the thigh, had been secured. The case was looking very favourably when I saw him, and trusting that the artery alone might have been injured, and not perhaps to any great extent, there was some ground to hope that, at least, the life of the patient might be saved, and a favourable period gained for amputation.

The foot and leg mortified, commencing very perceptibly on the fifth day; after which, he rapidly sank, and died on the tenth day.

Most extensive laceration was found to have taken place. Capsular ligament posteriorly, and the crucial ligaments were torn; the semi-membranosus muscle torn from its tendinous sheath; the popliteal artery and vein nearly torn asunder; the joint, and all surrounding parts, loaded with extravasated blood; the nerve uninjured.

The patient, by his distance from town, and the unfortunate delaying circumstances, was not seen by those on whom the responsibility of the case fell, until a tourniquet had been applied, and much consequent agony suffered during several hours. The shock and disturbance to the system was great; a palliative kind of treatment, one at least that might gain time, seemed the only course that could with present safety be adopted. Had I been at the first consultation, at midnight, I think it probable such would have been my opinion. With a somewhat extensive experience in amputations, I should at all times be reluctant to resort to that operation in a patient whose nerves had been put upon the stretch

for many hours, by pain and anxiety of no ordinary character, if by any other measure these could be for a time, or in a great measure removed. Rarely, indeed, have I seen such cases do well.

In a similar accident, under more favourable circumstances, that is to say, when the patient could immediately receive such surgical relief as might be decided to be the best, what should be the rule of practice?

Few more embarrassing accidents could occur. In the first place, the exact nature of the injury, and its extent, can only be very imperfectly estimated by the external appearances, and the degree of force, and mode in which it was applied. These are our only guides, and very insufficient ones. An external wound would make the case much simpler of diagnosis, and by so much a safer injury.

From the mode of the accident, I should be inclined to fear that the violence that would suffice to dislocate the knee, at the same time rupturing the popliteal artery, would also either have ruptured, or so far injured, by extension, the vitality of the vein, as to prevent circulation, and lead to the coagulation of the blood within its tunics, when, of course, amputation becomes imperative.

On the other hand, if such were not the case, we incur the risk of removing a limb which admitted of successful treatment. An incision down to the ruptured vessel, and the application of a ligature, might place the patient in a favourable state, provided this additional violence did not bring on such excessive

inflammatory action in and about the articulation as to lead to some disastrous result. If the vein were found injured, or extensive laceration, as in this case, of the synovial capsule, with great extravasation of blood, the patient would only have undergone a somewhat protracted operation, the termination of which would necessarily be amputation.

I have been led to the following conclusion, as, under all the circumstances, most likely to prove the safest practice.

When there has been great violence offered to an articulation, sufficient to produce dislocation, and evident injury to a large blood-vessel in the vicinity, an incision should be made down to the vessels, and the nature and extent of the injury ascertained. If the artery alone be implicated, the capsule not extensively lacerated, nor blood extravasated within, a ligature may be placed above and below the ruptured point of the artery, and the case treated with a view to saving the limb. If any of these adverse circumstances be found, amputation should be proceeded with.

CASE IX.

At present in the Westminster Hospital, under the care of Mr. White, is one of unusual interest, forming an example of a different kind of complicated injury to any I have hitherto noticed.

The patient is a child, aged six years and a half, and was admitted nearly nine months ago for a very

singular injury to the knee, occasioned by his getting his leg entangled in the wheel of a cabriolet, behind which he was riding.

A large lacerated wound extended across the ham, from one condyle to the other, through which the shaft of the femur, separated from its epiphyses, and denuded of periosteum, protruded, projecting as far downwards as the middle of the belly of the gastrocnemius muscle. The epiphyses retained *in situ*, and the patella uninjured. It is believed the capsule must have been opened merely from synovial-like fluid issuing, for some time after, from the wound.

Reduction was found impossible, and Mr. White determined on endeavouring to save the limb by sawing off a portion of the protruding shaft, and then reducing the remainder: this was done. The artery, vein, and nerve were found to be, *anterior* to the bone, uninjured. The reduction was now easily effected; five sutures were used, wet lint and a roller applied, and the limb was laid on the side, in a semi-flexed position, and secured by a splint.

This position was altered the next day, by his slipping partially through the opening, for the bed-pan, in the bed, and the limb was both disturbed, and flexed upon the thigh.

He has now got through a hard struggle for his life. The joint does not seem materially to have suffered. There is motion in it; but the leg is at an angle of about seventy-five with the thigh, and though with crutches, or with stooping, he can

get forward, and rest some weight upon it, a large piece of the shaft is evidently undergoing exfoliation, a corner of dead bone projecting at the wound. From the limb not being straight, though the case forms a wonderful instance of recovery by the exercise of bold surgery, it is doubtful how far the limb will be useful: but it is premature to decide upon that point yet; and in so young a child, during growth, nature may work still further wonders.

The joint was in very slight degree directly implicated, I have little doubt; and it has not been materially damaged by any subsequent diseased action, notwithstanding the terrible laceration across the popliteal space. I am led to believe that had the bone not been stripped of its periosteum, to which circumstance the exfoliation may be mainly attributed, and had the limb been maintained in a straight position,—a great difficulty, however, in so young a child,—there was every reason to anticipate in this, or a similar injury, without those two unfavourable circumstances, *a successful issue, in the shape of a good and useful limb.* If, from the wide gaping of the wound or other causes, the straight position were found untenable, I should decide for amputation, since I believe a lower limb much bent to be a greater evil than its total loss by amputation, although I admit the peril of an amputation being avoided is a consideration in favour of the palliative treatment.

CASE X.

It is often difficult to decide upon the course to be adopted in wounds and laceration of the wrist. It is now some months ago that a man was admitted into the same hospital, a circular saw having entered immediately below the carpal articulation, sawing off partially the heads of two or three of the metacarpal bones, with considerable laceration of soft parts; the detached portions of bone were removed, and the parts gently dressed.

Violent inflammation and suppurative disease ensued, involving the whole hand and lower part of the fore-arm. It remains yet a question, whether he will ever obtain the use of even a pair of pincers, in the fore-finger and thumb; the rest of the fingers, I should fear, were permanently disabled; a great deal of swelling, consolidation, and some suppurative disease still continuing, and no power or motion perceptible from the wrist downwards.*

I have seen the wrist recovered, in other instances, from an apparently worse character of injury, such as the passage of a ball through the carpal bones inflicts. These are cases, as I have observed, eminently uncertain in their results.

* Five months have now elapsed; he has long been out of hospital; the hand is still in a swelled and very diseased state, with a sinus from which discharge proceeds.

CASE XI.

I shall allude to one more case only. A gentleman, in 1835, was thrown out of his gig, and fractured the upper third of the ulna into the elbow joint. He was a stout muscular man, and considerable swelling supervening, before his surgeon saw him, the fracture did not seem to have been discovered until some degree of union had taken place, and that at such an angle, that a sharp peak projected at the posterior surface, rendering any attempt at flexion painful in the extreme, "cutting like a knife," as the patient described, from the stretching of the skin over the sharp end of bone.

Returning from abroad, for a few months, after the close of the civil war in Portugal, the patient, who was an old friend, begged me to examine his arm, and take charge of him, if I thought anything could be done. Gentle passive motion and friction had been adopted, but the time had arrived, it appeared to me, when more force was required, and no perceptible advantage could be obtained without it.

I founded this opinion upon my diagnosis, that mere ligamentous bands, uniting the two fragments at an angle, prevented the flexion of the arm, and that it required regulated, but considerable force, to elongate these. Before it could be attempted, the sharp projecting end of bone required removal.

As he had received different opinions from other

medical men, some his personal friends, I advised him, before any thing was done, to come up to town, that I might consult one or more of the leading surgeons. Our president, Sir B. Brodie, may perhaps remember seeing him with me. The patient consulted also Sir Astley Cooper, who took the same view of the case that I had done.

I removed the projecting end of bone, and as soon as the incision was soundly healed, I employed, morning and evening, a moderate degree of forcible extension, gaining by measurement, a very little each two or three days, but never proceeding so far as to excite inflammation. The case rapidly improved, and he has long recovered the perfect use of his arm, can carry his hand to the shoulder of the same side, row, &c., without pain or difficulty.

Cases of this kind have led me to the following conclusion. Wherever a partial anchylosis takes place, proving that there is not that kind of bony union, (of which there is a fine example among the specimens,) and no fragment of bone locks, so as to give the conviction, that unless it be broken, no farther progress can be made, the limited motion will generally be found to depend upon ligamentous bands or adhesions, which will elongate by the judicious use of force, to be employed twice daily, neither violent, nor long continued, but so as perceptibly to gain by measurement, something, however little, each two or three days. In such cases, the gentle kind of passive motion, together with the frictions generally recommended, are perfectly in-

adequate, and altogether useless, except during the first few days after union, to facilitate the absorption of the effusion and thickening which may remain in the soft parts.

In conclusion, it is evident, that there are many different kinds of injuries to joints, independent of all other varying circumstances which influence the progress and termination of a case. Although it may be difficult or impossible to lay down rules which shall provide for every contingency or possible complication, yet the injuries according to their nature, and the leading principles of treatment applicable to each class thus defined, may be established in a clear and comprehensive manner, and one important step taken towards the simplification and improvement of our knowledge.

These injuries I have been led to class in the following manner, in reference to the principle of their treatment. Instances of the greater number I have just related, and the conclusions on which, it has seemed to me, their treatment should be based.

First Class.

1. Incised or lacerated wounds penetrating the capsule.
2. Penetrating wounds, with partial abrasion or contusion of articulating surfaces.
3. Simple fractures into joints, with more or less displacement, and subsequent confined ligamentous union.
4. Fissuring of articulating surfaces, from com-

pound fractures, complete or partial in the vicinity, but without displacement of bone within the capsule.

In this first class are included those cases, the great majority of which may be saved, and when it should be a principle of practice to attempt it. Of course, in the last division, fissuring from compound fractures, much judgment is required, to determine the curability of the fractured limb; the rule laid down is applicable only *quoad* the articulation. Moreover, in cases of fissuring from compound fractures, it will often happen, that only the head, or head and neck of the bone may be seriously damaged, and this, either with or without a foreign body lodging. Several fine specimens of this kind of injury are among my preparations. Here the limb may be frequently saved, as I have already shown, though not the joint, by excision of the head of the bone, or removal of the fragments.

Second Class.

1. Foreign bodies lodged in the ends of bones, either not presenting in the articular surface, or on the same level and smooth.
2. Foreign bodies traversing the ends of bones, without detaching fragments from the articular surfaces.
3. Internal laceration of ligamentous structure, with lesion of blood vessels, and with or without temporary displacement of articulating surfaces.

4. Separation of shaft from epiphyses with possible laceration of capsule, but not extensive.

This second I have described as an *intermediate class*, ranging between those in which the principle is laid down that the limb may be saved, and those included in the third class, where the contrary rule holds, viz., that the attempt to save should not be made.

The intermediate class includes four kinds, like the first: and these of all the injuries to joints require the most accurate diagnosis and sound judgment in determining the line of practice, whether to attempt to save, or, at once, to condemn. I have succeeded in saving many of this class, but it certainly is not always judicious to make the attempt; and therefore have endeavoured to establish certain conclusions, having particular reference to the principles of decision to be adopted in the varieties in this class.

Third Class.

1. Compound fractures into joints, with displacement and roughened edges.
2. Foreign bodies projecting into articulation, or traversing with extensive injury to structure.
3. Lacerated wounds of capsule, with much contusion and injury to internal structure of articulation, and with extravasation of blood into the joint.

The third class includes those kinds or varieties

of injury, amounting to three, in which the principle of practice should be to amputate without delay, unless excision of the articulating ends be judged advisable. The injury being of an irremediable character, the system, from the first moment takes the alarm, and each succeeding hour diminishes the power of the patient, rapidly involving, not only the joint, but often the whole limb, in a hopeless suppurative and disorganizing action.

I have alluded to a case under my own care, in which an anchylosed limb was saved, in an injury of the elbow, coming within the definition of the first kind in this class, viz., compound fractures into joints, with displacement and roughened edges. But this was by means of partial excision, and, except in the lesser articulations, the hand or foot, this is the only favourable case I have met with; such a result may be obtained, in the ancle, under very favourable circumstances.*

In the second kind, viz., foreign bodies projecting into articulations, or traversing them with extensive injury to the structure, I have never known a recovery to take place, in any of the large articulations—more particularly the knee and shoulder; and very rarely in any of the smaller joints, such as those of the wrist, hand, and foot.

An extensive injury to a joint will sometimes destroy the patient by the shock. Or a wound of an

* A favourable case of this nature, at present under observation, is now rapidly recovering after partial excision; the system never having sympathised to any alarming extent.

articulation may be complicated with some other grave injury; such as a penetrating wound of the chest. Unless the second wound be of fatal character, I do not think it should prevent the necessary steps being taken with reference to the joint. In one such case, I amputated at the shoulder joint, and although the patient ultimately died, having been seized with a bilio-remittent fever, which attacked nearly all the amputations of the period, he did not die till the thirty-first day: the *lung, however, presented no trace of active disease*, although the wound was in the chest, the morbid actions seemed to have been expended upon the vicinity of the articulation.

The most excessive action sometimes follows a slight injury, and I have known erosion of the cartilages take place in five days. In another case, a superficial wound of the inside of the knee seemed to develope the most frightful actions, local and general, destroying the limb with suppurative disease, and consuming all vital power by fever. The ball which had curved down towards the ham-strings, but still superficially, I removed on the sixth or seventh day, and he died about the fifteenth.

At other times there will be, comparatively, little action in the joint itself, and the whole mischief be expended below; or again, I have known a joint filled with pus, but no erosion or alteration whatever in the cartilages.

It is worthy of remark, also, that a joint often becomes secondarily affected, and with so little at-

tendant pain, as to escape observation for some time.

With these brief hints on the irregular or less usual effects of these injuries, which seem to follow no certain law, and therefore may baffle the most judicious prognosis, I must close my observations.

The facts and conclusions on which the opinions here given have been founded, are the fruits of some experience and opportunities of observation, on a scale not easily or generally obtained. Many remarkable and successful cases have tested such of these opinions as lead to the attempt to save a limb, which, in these injuries, if injudiciously resolved on, too often terminates fatally for the patient's life. A feeling already exists, sufficiently general, that all severe injuries to joints require amputation. Nevertheless while my object has been to define with accuracy certain kinds that admit of treatment with a fair prospect of a useful limb as the result, I have endeavoured to furnish the necessary data to guard against any possible error of an opposite nature; the tendency of which might be to lead to the attempt to save a limb, in cases deservedly esteemed hopeless.

I trust these observations may contribute, in some degree, to fix the principles of treatment, especially as relates to amputation and excision, applicable to the various kinds of a class of injuries of common occurrence in civil and military life, of great interest and importance, yet, hitherto, but lightly dwelt upon by surgical writers in civil practice.

ON

ANEURISMS,

AND ESPECIALLY

SPONTANEOUS VARICOSE ANEURISMS OF THE ASCENDING AORTA,

AND

SINUSES OF VALSALVA.

WITH CASES.

By JOHN THURNAM, Esq.

READ MAY 12TH, 1840.

The pathological conditions of the ascending or pericardial portion of the aorta, constituting the primary trunk of the arterial system, and preeminently liable to all those forms of disease, which predispose to aneurism, are generally admitted to be particularly worthy of study. This claim to our attention, however, becomes much increased when we consider the effects, which aneurisms of this portion of the aorta, produce on adjacent organs. For, not only may aneurisms thus situated, in common with those of other parts of the thoracic aorta, project forwards, and erode the sternum or ribs, compress

and become ruptured into the lungs, trachea, bronchi, or œsophagus, or into the cavities of the pleuræ or pericardium, but they may also compress, obliterate, and even form communications with the large venous trunks, by which the ascending aorta is surrounded, and thus constitute spontaneous varicose aneurisms of an extraordinary character. Further, as I have stated in a previous paper, "Aneurisms in this situation often burrow and become ruptured into the substance and cavities of the heart itself."* It is, then, to the pathology and diagnosis of some of the last-named and less common forms of aneurisms of the pericardial portion of the aorta, which have hitherto been barely noticed by authors, that this paper will be chiefly devoted.

In consequence of witnessing a remarkable case of aneurism of the right aortic sinus of Valsalva, which opened into the right ventricle, (see case 7,) my attention became directed to the probable effects of aneurisms of each of the three aortic sinuses, especially in relation to the particular cavity, whether of the heart, of a blood vessel, or of the pericardium, with which, in case of their becoming ruptured, they would probably communicate. I have endeavoured to determine this question, by two modes of investigation: 1stly, by anatomical examination and experiment, and 2ndly, by comparing the results of cases of aneurism thus limited, whe-

* "On Aneurisms of the heart." (Medico-Chirurgical Trans., vol. xxi. p. 243.)

ther recorded in the annals of medicine, preserved in museums that I have visited,* or occurring under my own observation.

Anatomy.—The ascending aorta has a somewhat curved form, with its convexity directed to the right. At its commencement, it is covered anteriorly and to the left by the pulmonary artery; on the right by the right auricular appendage, the tip of which overlaps it in front; and behind, it rests on the sinuses of the two auricles, the septum of which corresponds nearly to its median line. As it ascends, it lies, first, in front of the right pulmonary artery, as that vessel crosses behind it in its course to the right lung; and then it gets in front of the right bronchus and the bifurcation of the trachea: it is bounded on the right side by the superior vena cava, and on the left by the pulmonary artery; anteriorly, it is separated from the sternum only by the approximating margins of the two lungs. This portion of the aorta is included within the bag of the pericardium, the serous layer of which invests it in every part, except where it is in contact with the pulmonary artery.

The ascending aorta is often described as wanting the external cellular tunic common to arteries; but it is more accurate to say, that the cellular tunic, in this situation, is slighter, and consequently less

* The various preparations which are referred to in this paper, as existing in the museums of London and Dublin, have been particularly examined by me. I mention this, as I sometimes refer to morbid conditions which exist in the specimens, but which are not described in the published notices of the cases.

extensible, than in any other part of the arterial system. At the very origin of the aorta, there exist three roundish dilatations corresponding to the three semilunar valves, which were first described by Valsalva, and are known by the name of the smaller sinuses of the aorta.* These sinuses have, hitherto, not been generally indicated by names; for the sake, however, of convenience in this paper, I shall speak of them as the right, left, and posterior aortic sinuses. By the right and left, I mean the two sinuses which are seated anteriorly, and from which, respectively, the right and left coronary arteries arise; and by the posterior, I intend that which does not give origin to any coronary vessel. The term posterior, which is sanctioned by the authority of Valsalva himself, appears to me to indicate the position of the sinus last alluded to, better than that of "intercoronary," which has been applied to it by M. Bizot. All the sinuses are imbedded in the soft fat, generally found at the base of the heart; but the right is seated more superficially than either of the other two.

By passing needles through the coats of the aorta, in the situation of the sinuses, I have ascertained, that when affected by aneurismal or other disease, any one of them might become ruptured into the pericardium; but that the right is more liable to do so than either of the others. By the same means, I have found, firstly, that the right

* See Cyclop. of Anatomy and Physiology, article Aorta. Vol. i. p. 188.

sinus might form a communication with the top of the right ventricle, with the pulmonary artery, or with the right auricle at the mouth of the appendage; secondly, that the left aortic sinus might become ruptured into the left auricle, the left ventricle, or the pulmonary artery; and thirdly, that the posterior aortic sinus might open into either the right or left, though more readily into the right auricle. I have likewise found that the ascending aorta, for some distance above the valves, has very similar relations to the adjacent parts as the sinuses themselves; but that, as indeed is obvious from simple inspection, the relations of aneurisms of the higher part of the ascending aorta, are with the superior vena cava on the right; the pulmonary artery on the left; the pericardial cavity in front; and with the right pulmonary artery and veins, and with the right, and in a less degree, the left bronchus behind.

LIABILITY OF THE RESPECTIVE SINUSES TO ANEURISM, AND THEIR RELATION TO ADJACENT PARTS.

Reference will be made in this paper, to eighteen cases of aneurism, which were more or less accurately limited to the aortic sinuses. In two of these cases, (15, 19,) there were aneurisms so limited in two of the sinuses; and, in another instance (6), the three sinuses were all affected. Of these twenty-two aneurisms, twelve were seated in the right, four in the left, and six in the posterior aortic sinus.

Though we cannot draw any certain inferences from so limited a number of data, yet I think they are sufficient to justify somewhat more than a conjecture, that the right sinus is more liable to aneurism than either of the others. Of the twelve aneurisms seated in the right sinus, two were of an incipient form, and, doubtless, projected into the pericardium;* two had ruptured into that cavity;† six projected into, and one (7) had actually formed a communication with the highest part of the right ventricle. Of the four aneurisms seated in the left sinus, one (19) had become adherent to the left auricle; and another (14) had formed a large tumour in the upper part of the left ventricle. Of the six aneurisms seated in the posterior sinus, two

* *Cases of Aneurism of the aortic sinuses, projecting, but not ruptured into the pericardium.*—Case 15. Hodgson on Diseases of Arteries, 1815. Case 10, Plate 2, p. 49. Aneurism both of the right and left sinus.

Case 16.—Hodgkin, Medical Gazette, 1829, vol. iii. p. 488. Mus. Guy's Hospital, No. 1427 D. In this case, there was an aneurismal dilatation of the right aortic valve, as well as of its corresponding sinus.

Case 17.—Mus. St. Thomas's Hospital, No. 608 C.

Case 18.———————————— No. 618. This case presents a second aneurism (above that of the sinus) which has ruptured into the pericardium.

Case 19.—Mus. St. Bartholomew's Hospital, No. 42.

† *Cases of Aneurism of the aortic sinuses, ruptured into the pericardium.*—Case 20. Mus. St. Bartholomew's Hospital, No. 2. From a male patient, at forty, who died suddenly, in apparent health, after a hearty supper.

Case 21.—Mus. Fort Pitt, Chatham, No. 13.

were incipient, and probably projected into the pericardium; one (26) projected, as a round tumour into both the auricles, but principally into the right; and one (6) probably had become ruptured into the sinus of the right, and another (13) into that of the left auricle.

That portion of the ascending aorta which is immediately above the valves, is probably even more liable to circumscribed true aneurism than are the sinuses of Valsalva themselves. I might refer to many cases of aneurism thus situated, in the writings of Morgagni, Scarpa, Burns, Sir A. Cooper and others, but as the precise position of the aneurismal sacs is not indicated, these cases do not require further notice here. I am, however, inclined to believe that those portions of the ascending aorta which are directly above the attachment of the semilunar valves, and which consequently are seated above and between the aortic sinuses, are more liable to the formation of aneurism than are the intermediate portions. I can refer to at least ten cases thus seated. Of the eight aneurisms seated above the attachment of the right and left aortic valves, three (22, 23, 24,) had become ruptured into the pericardium; one (38) projected, and threatened to burst into the right, and another (27) into both the right and left ventricles of the heart: whilst, in four cases, the aneurismal sac was ruptured into the pulmonary artery. In one case (5), seated above the insertion of the right and posterior valves, the sac had become ruptured into the right auricle; and in another (25),

above that of the posterior and left, the sac appears to have projected into the sinus of the left auricle, and had become ruptured into the pericardium.*

Varicose Aneurism, with its modification aneurismal varix, has, until very lately been regarded as uniformly produced by a wound of an artery and its accompanying vein. M. Breschet, even, in his valuable memoir on these forms of aneurism,† does not allude to the possibility of this lesion being spontaneous in its origin.

Previously, however, to the publication of the memoir of M. Breschet, Mr. Syme had narrated an interesting case of spontaneous varicose aneurism in the abdominal aorta and cava. Two important cases likewise, the one by Mr. Porter, and the other by Mr. J. G. Perry, in which spontaneous varicose aneurisms existed in the popliteal and femoral arteries and their accompanying veins, have also been published; for the precise nature of the latter case having been established by dissection, that of the former appears to me no longer conjectural.‡

* *Cases of Aneurism above and between the aortic sinuses, ruptured into the pericardium.*—Case 22. Mus. St. Bartholomew's Hospital, No. 51.

Case 23.—Mus. Guy's Hospital, No. 1478.

Case 24.—Author's Collection. F. 16. History not known.

Case 25.—Morgagni. Ep. 26, S. 13. From a female, aged twenty-eight, who died in actu coitus.

† Mem. de l'Acad. de Méd., tom. iii. 1833.

‡ W. H. Porter, Cycl. Anat. and Phys. 1835, vol. i. p. 242.—J. G. Perry, Med. Chir. Trans. 1837, vol. xx. p. 31. This last very important case has been alluded to by Dr. Hope, "Diseases of

When we consider, in the first place, the liability of the ascending aorta to aneurism in general; in the second, the close manner in which this vessel is surrounded by the superior cava, the right auricle, the right ventricle, and the pulmonary artery,—all portions of the venous system; we should, I think, *a priori*, be justified in concluding that it is a part of the arterial system particularly exposed to such a spontaneous intervascular communication as constitutes varicose aneurism.

It may perhaps be necessary in this place to meet the objection that very possibly will be made, that to call an aneurismal sac which has ruptured into one of the right cavities of the heart or into the pulmonary artery, a spontaneous varicose aneurism, is a "pathological transcendentalism," "founded on a far-fetched, though ingenious, analogy." I have, therefore, been gratified to find since a great part of this paper was written, that Mr. Smith, of the Richmond Hospital, Dublin, has taken a similar view of the subject; and has anticipated the probable occurrence of such a lesion as spontaneous varicose aneurism, in the very centre of the circulating system. In remarking on a case to which I shall have to allude (27), and the preparation of which I have had the advantage of inspecting in his company, Mr. Smith observes, "had the sac yielded where it projected into the right ventricle, there would have

Heart," 3rd ed. p. 605; and his description of the physical signs is very valuable, though some inaccuracy appears to have crept into his history of the other details of the case.

been formed a varicose aneurism of a new and extraordinary description, and I should think not of necessity at once fatal."

But it is not merely on speculative grounds that I would contend for this view of the subject; for, as I hope to show, there is somewhat more than a general analogy between the phenomena presented by the ordinary varicose aneurism of the extremities and those observed in the cases under consideration.

I may now proceed to detail, as concisely as I am able, the cases before me, in which a spontaneous varicose aneurism of the ascending aorta existed; and, following the course of the circulation, I shall relate various cases in which the superior vena cava, the right auricle, the right ventricle, and the pulmonary artery, were, respectively, the seat of the varicose communication. I shall first, however, describe three cases in which the descending aorta and inferior cava were the vessels affected.

CASE I.

Spontaneous varicose aneurism of the abdominal aorta and vena cava.

Robert Scott, aged twenty-two, early in October 1830, began to complain of pain in the back and limbs; with throbbing in the epigastric region, and an incessant whizzing noise proceeding from the same part. At the end of three or four weeks, his sufferings had become so severe as to confine him to bed, and at this period he was first seen by

Mr. Syme. He then complained of great pain in the back, and of coldness of the feet; but the symptom which occasioned himself and his friends the greatest uneasiness, was the constant noise. Upon examining the abdomen, a large pulsating tumour was readily felt: the pulsation however was not so strong, nor the tumour so incompressible, as in an ordinary aneurism; and, in the erect posture, it might readily have escaped detection. Notwithstanding the employment of various means, with the view of moderating the force of the circulation, the symptoms became aggravated, and œdema of the inferior extremities, and of the organs of generation appeared. This gradually increased to a great extent; and the swollen condition of the legs was remarkably contrasted with the emaciated arms. He died rather suddenly, at the latter end of January 1831, immediately after complaining of a pain at the heart.

Dissection.—The œdema had diffused itself all over the body; and the subcutaneous tissue of the trunk was distended with serum, to the thickness of three inches. There was an aneurism of the aorta at its bifurcation, which adhered intimately to the vena cava and to the vertebræ. It was of a flattened oval figure, the size of a large orange; and had produced absorption of the bodies of the three lowest lumbar vertebræ. The vena cava was much flattened and thickened, and communicated with the sac by a round aperture, somewhat larger than

a sixpence, immediately above the common iliac veins.*

I am indebted to the kindness of Mr. R. R. Robinson, of Camberwell, for the particulars of the following very interesting case.†

CASE II.

Spontaneous varicose Aneurism of the Abdominal Aorta and Vena Cava.

A man, aged forty, received a hurt on the back, which he felt for a few days, and then got rid of; but from which he continued to suffer occasionally. At the end of two and a half years, soon after getting wet through, and sitting in wet clothes, his legs began to swell. Five weeks after this, he came under the care of Mr. Robinson: his face had become very pale, the inferior extremities and scrotum unusually swollen, the skin being very tense, pale, and cold; the veins about the abdominal parietes numerous and varicose; fulness and indistinct fluctuation in the abdomen; pulse quick, vibratory, and slightly hæmorrhagic; urine bloody, and had been so for a fortnight. He never complained of any

* Edin. Med. and Surg. Journal, vol. xxxvi. 1831. The preparation is preserved in Mr. Syme's Museum.

† See also Med. Gazette, vol. xiv. p. 462, 1834, and Proceedings of Hunterian Society, 1834, in London Med. Journal, by Dr. Ryan, vol. vii. 1835, p. 594.

beating in the abdomen. By stethoscopic examination of the chest, nothing unusual was detected, except a rather diminished impulse of the heart.

The case was regarded as one of inflammatory dropsy, and was treated by calomel, elaterium, &c. After cupping on the loins, he felt "as if a load was removed from the kidneys;" in the course of two days the urine had lost all appearance of blood; and when examined three weeks afterwards, it did not coagulate by heat. He was freely purged by the medicine, and the swelling of the legs and scrotum was decidedly diminished. At the end of three weeks, however, the dropsical condition, both of the legs and abdomen, increased; the veins about the latter became very large, tortuous, and purple; the face was puffy and slightly œdematous; there were cough, dyspnœa, and difficult decubitus. The swelling went on increasing, so that the skin of the legs began to inflame, and actually to burst; and in this way, and by acupuncture a large quantity of serum was discharged. The remedies and the acupuncture, combined with bandaging, were repeated; and two months after coming under Mr. Robinson's care, the legs had diminished greatly in size, and the cough and dyspnœa were much relieved. A sloughy sore had, however, formed on each shin; and the urine was very high-coloured, and deposited a red sediment. For six weeks after this he continued to improve; the swelling was much diminished, and he appeared almost convalescent, when he died sud-

denly, five months after the first appearance of the dropsy.

Dissection two days after death.—The œdema had entirely disappeared. *Thorax.*—The lungs were mottled and congested; the pleuræ were unadherent, and contained a pint of serum. The heart was large, and all its cavities, but especially the right, were loaded with partly fluid, partly coagulated, black blood. The aortic valves were thickened, and the coats of the aorta presented some steatomatous deposit. The *abdomen* contained very little fluid; the liver was of usual size, soft, and nutmeg-like in appearance. The stomach and intestines were healthy. The descending aorta was considerably dilated, and formed a white tumour, having the lumbar glands, some of which were enlarged, imbedded in its substance. The dilatation was of the diffused kind, and extended from a little below the renal arteries, nearly to the bifurcation. The tumour was strongly adherent to the bodies of the lumbar vertebræ, which were scabrous, and formed the posterior wall of the aneurismal sac. The sac contained some fluid blood, and several recent clots, but none in layers: its interior was rough, from osseous deposit under the inner coat; and it communicated by two distinct but small and round openings with the inferior cava. The edges of these openings were smooth and rounded, as if they had undergone reparation, and they were only separated from each other by a small bridle. The inferior cava presented no other abnormal appearance.

CASE III.

Spontaneous varicose Aneurism of the abdominal Aorta and Vena Cava. Death in a few hours after the probable period of formation of the opening.

A butler, aged fifty-two, who had suffered for two years from severe pain of the back, stretching across the loins, was suddenly seized, whilst performing his usual duties after dinner, with violent vomiting, accompanied by general depression. When seen soon afterwards by Mr. Woodhead, violent throbbing of the abdominal aorta was felt in the umbilical region. He died at two o'clock the next morning.

Dissection.—The heart and other thoracic organs were healthy. The lower part of the abdominal aorta, just above its bifurcation, was dilated into an aneurism the size of a small orange. Near the centre of the right wall of the aneurism, there was an opening of an irregular form, the size of the point of the little finger, which communicated directly with the inferior cava. The whole calibre of this vessel was slightly dilated at the part where the communication existed. The posterior wall of the aneurismal sac had been entirely absorbed, and there were several firm fibrinous concretions occupying its place in front of the lower part of the third and the fourth lumbar vertebræ, the bodies of which were deeply excavated from absorption, whilst

the inter-vertebral substance had apparently undergone no change.*

CASE IV.

Spontaneous varicose Aneurism of the ascending Aorta and Superior Vena Cava.

A coachman, aged forty-one, of intemperate habits, and much exposed to wet and cold, had been subject to cough, dyspnœa, and palpitation, as long as he could remember. In the spring of 1833, he felt less vigorous. In the middle of June he suffered from pain in the neck and shoulders, which after a few days ceased: upon which, his face became purple and swollen; and, in a few days, the right arm, and the integuments of the trunk, as far as the base of the chest, especially on the right side, also became œdematous: his legs wasted, and he became feeble. Clusters of veins, almost varicose, appeared over the chest and back; the dyspnœa, palpitation, and cough, with viscid expectoration, increased; he suffered from a sense of weight and stiffness about the shoulders; and, towards night, felt dizzy and confused; the pulse was 100, and rather hard.

Auscultation.—There was dullness, on percussion, beneath the right, and clearness under the left clavicle; a distinct impulse under the right clavicle,

* Dr. J. Reid, Edin. Med. and Surg. Journal, vol. liv. 1840, p. 115.

and on the right side of the top of the sternum, with a loud " bruissement, like the vibration of a string," in the same situation; this sound was also heard, though not so loudly, over the right carotid and over the origin of the aorta: there was some crepitating wheeze over the back of the chest, especially towards the upper part.

He was cupped beneath the shoulder; had leeches applied repeatedly under the right clavicle; and took elaterium, squill, and other diuretics. The difficulty of breathing became more and more severe, especially towards night, but was always temporarily relieved by the leeching; the sputa became tinged with blood, the expectoration difficult, and the cough more troublesome. Towards the end of July, he suffered from slight delirium with stupor, tightness round the throat, and wheezing respiration. Six days before death, the œdema extended to the left arm, and the ankles and scrotum were slightly swollen: the countenance and eyelids had become intensely tumified, and the breathing was more oppressed. During the last three days of his life, the delirium was almost constant; on the 4th of August he had a severe fit of dyspnœa, followed by profuse perspiration, and marked subsidence of the œdema over the temples, and in the eyelids. He gradually sunk, and died in the evening of the same day, a month after admission into St. Bartholomew's Hospital; where I had an opportunity of witnessing the

Dissection, twelve hours after death.—Thorax. The

lungs were crepitant throughout; but there were adhesions of the pleura on both sides; and on the right side, the lower half of this membrane was thickened, to the extent of a quarter of an inch, by the presence of white layers of false membrane. The heart was large, from dilatation of the ventricles, without increase in the thickness of its walls: the valves were in their healthy state. There was a diffused true aneurism of the ascending aorta, which extended for an inch and a half above the valves, to the origin of the arteria innominata, and principally affected the right side of the vessel. It formed a tumour as large as the fist, which corresponded to the three upper right ribs, and was in front of the superior vena cava. The aneurismal sac contained some grumous coagula; its coats were very thin, and its lining membrane friable, posteriorly and to the right: in this part there was a round opening, with smooth edges, and about a quarter of an inch across, which communicated with the superior vena cava, about half an inch above the opening of the vena azygos. The vena cava contained a coagulum of blood.

Abdomen.—The liver was firm, and rather small; the kidneys and other viscera were healthy.*

I am not aware that any case, similar to the foregoing, has before been recorded; and it must be re-

* See an anonymous Report in the Lancet, vol. ii. 1832-3, p. 666. The preparation is in the Museum of St. Bartholomew's Hospital. Arteries. No. 84.

garded as a most important one; especially in connexion with the physical signs, which had a most striking relation to the point of communication between the vessels.

Reference has been made, by Otto, to a case in which an aortic aneurism had opened into the right auricle, but which I have not succeeded in finding.* An interesting case of the same description, has however been recently published, by Mr. T. B. Curling; who has favoured me with an opportunity of examining the preparation. The following is an abstract of the case.

CASE V.

Spontaneous varicose Aneurism of the ascending Aorta and appendage of the right Auricle.

A man, aged thirty-five, whose history is defective, had laboured, for at least four months, under *general anasarca, cough,* and great *dyspnœa.*

The pulse was weak and resilient; and there was a distinct pulsation, with bellows murmur, to the right of the sternum. Under bleeding, and the use of elaterium and digitalis, the anasarca was removed; but the difficulty of breathing continued to increase, and amounted to orthopnœa; his face became livid and anxious.

* Med.-Chir. Journal, vol. vi. p. 617.

About twenty-four hours before death, (November 27th, 1834,) the dyspnœa became dreadfully urgent; he could not bear the clothes near his chest, but kept throwing his arms about, calling out for fresh air; and so struggled, in the greatest possible distress, until he expired.

Dissection.—The superficial and deep-seated veins, especially of the head and neck, were extremely turgid.

Thorax.—There were some old adhesions of the right, and about sixteen ounces of serum in the cavity of the left pleura. The lungs were sound, but congested. There were four ounces of serum in the pericardium. The left ventricle was considerably hypertrophied and dilated: but, excepting a small ossific deposit in one of the valves of the aorta, the valvular apparatus of the heart was healthy. There was an aneurism of the ascending aorta, the size of a hen's egg, which had a rather contracted mouth, directly above the attachment of the right and posterior aortic valves. This aneurism was adherent to the appendage of the right auricle, on which cavity it encroached considerably.

The lower part of the aneurismal sac communicated with the cavity of the auricle, just behind the appendage, by a round opening, that would admit a crow-quill.

Abdomen.—There were about twenty ounces of serum in the peritoneal cavity. There was extreme

sanguineous congestion of the liver, with an injected state of the portal system.*

The particulars of the following important case were published, whilst I was engaged in the revision of this paper.

CASE VI.

Spontaneous Varicose Aneurism of the three Sinuses of Valsalva, right Auricle and Termination of the Superior Cava.

A tin-smith, aged thirty-five, addicted to the use of spirits, had long been subject to fits of palpitation, when he felt an uneasy sensation in the chest, like something giving way, whilst raising a heavy weight. He, shortly afterwards, became affected by œdema, and lividity of the upper part of the body, with confusion of the intellectual faculties. Three weeks after the accident, he was admitted into the Royal Infirmary, Edinburgh, under the charge of Dr. Peebles. The arms and chest, but more especially the face and neck, were of a livid colour, and highly œdematous; and the vessels of the conjunctiva were congested. He had much dyspnœa, with some cough, and difficulty of deglutition. The pulse ranged from 90 to 100, and there was a distinct interval between the beat of the heart and of the artery at the wrist. The urine was scanty and turbid, but not coagulable. There was strong impulse

* Medical Gazette, N. S., vol. i. 1838, p. 895; also London Medical and Surgical Journal, vol. vii. p. 594.

of the heart, the apex of which was felt lower down than usual; a double bellows-sound was very audible over the cardiac and sternal regions, particularly the upper part of the latter. The murmur, accompanying the systole of the heart, was more prolonged; that with the diastole, was sharper and shorter. Satisfactory percussion of the chest could not be obtained, on account of the great œdema; but there was obviously extended dulness in the region of the heart, and upper part of the sternum. The respiratory murmur was very loud at the upper angle of the scapula. The diagnosis was "hypertrophy of the left side of the heart, with aneurism of the aorta;" and he was treated with drastic purgatives and digitalis. He had been previously bled and cupped. The dyspnœa became more urgent, so that he was unable to assume the horizontal position, for any length of time; the œdema and lividity of the upper half of the body continued, but, excepting slight swelling of the scrotum, did not extend to the lower half. Some dark, circumscribed, livid spots appeared on the chest; he was delirious at night, and his eyes were blood-shot. He died suddenly, a week after admission.

Dissection, the third day after death.—Thorax. There was about a quart of serum in each cavity of the pleura. The lungs were small and compressed, and contained a considerable quantity of blood and frothy serum. The pericardium was universally, and firmly, adherent; and the heart was decidedly larger than usual. All the cavities of the heart were considerably hy-

pertrophied; and the left ventricle was likewise dilated. The walls of the heart were paler and more flabby than usual: the valves were healthy: the aorta, at its origin, was suddenly dilated, and formed an aneurismal cavity, the size of the fist. This large cavity appeared to be limited to the three sinuses of Valsalva; it was bound, superiorly, by three large segments of a circle, formed by the fibres of the artery which limit the sinuses, in a thickened and elongated condition. The aortic orifice was not enlarged. The ascending aorta, above the aneurism, was somewhat thickened and roughened on its internal surface, but was not dilated. The dilated arterial tunics, forming the aneurismal sac, were thin and very soft, and in some points, which were closed by the adherent pericardium, or the walls of the auricles, were deficient. The aneurism projected into the anterior and left part of the right auricle, where it had the termination of the superior cava stretched over its outer surface. There was a free communication of this portion of the right auricle, and the termination of the superior cava, with the aneurism, by two oval openings, with defined and rounded edges, which were barely capable of receiving the point of the little finger. The vena cava itself was pervious, but must have been compressed by the aneurism. Where the aneurismal sac projected against the anterior wall of the left auricle, there was a thin, dark, and projecting portion, which appeared ready to become ruptured. The blood was fluid, and there were no fibrinous con-

cretions in the aneurism. The abdominal organs were healthy. The brain was not permitted to be examined.*

The foregoing are the only cases, with which I am acquainted, where an actual communication had been formed between an aneurism of the ascending aorta and the right auricle. I have, however, dissected the heart of a man, in whom such a communication appeared to be on the point of taking place.†

The following most interesting case occurred in the practice of Dr. Roe, in the Westminster Hospital, where I had an opportunity of carefully observing it. As Dr. Roe intends, I believe, to make this case the subject of a distinct paper, I shall only introduce a brief abstract of it in this place.

* Dr. J. Reid, in Edin. Med. and Sur. Journal, vol. liii. 1840. p. 96.

† *True aneurism of the posterior aortic sinus, threatening to burst into the right auricle.*—CASE 26. Edward Wilson, aged forty-two, died in the Westminster Hospital, April 1836, after having laboured, during eight months, under symptoms of diseased heart, accompanied by an irregular pulse, and a bellows murmur, of variable intensity, over the arch of the aorta.

In this case, I found a true aneurism of the posterior aortic sinus, which would have contained about two ounces of fluid. The aneurism projected into both auricles, especially the right, into which, in consequence of thinning of its coats, it was ready to become ruptured. The heart was hypertrophied and dilated, especially on the right side, and weighed 17½ oz. avoir.

CASE VII.

Spontaneous Varicose Aneurism of the right aortic Sinus and summit of the right Ventricle of the Heart.

In a baker (John Mitchell,) aged 33, thirteen years after severe rheumatism, during violent exertion, in apparent health, sudden sense of "cracking" in region of the heart, with faintness, palpitation and dyspnœa, followed by rapidly advancing anasarca, sanguinolent and viscid sputa, great sense of cold, &c.; extremely jerking pulse, extraordinarily superficial, and continuous sawing sound, with purring tremor, supplanting normal sounds of heart, and remarkably intense in second left intercostal space, two inches from sternum.* Death in eleven weeks.

Dissection.—True aneurism of right anterior aortic sinus, projecting into, and communicating by two small rounded apertures, with right ventricle: recent endocarditis; more or less insufficiency of pulmonic, mitral, and aortic valves; hypertrophy, and dilatation of heart; hydropericardium; hydro-

* Dr. Hope, who has given a sketch of this case, which he saw at my request, "Diseases of Heart," Ed. 3rd, p. 466, states that the sound and tremor did not extend above the third rib. From *repeated* observations, however, I have no hesitation in stating, that the sound and tremor were most distinct in the second intercostal space; and in this I am confirmed by the written notes of Dr. C. I. B. Williams, who also witnessed the case.

thorax of right side; pulmonary, bronchial, and hepatic-venous congestion.

Since the preceding case occurred, I have made considerable research, but have met with no similar one; and I believe it to stand perfectly alone. But although it is the first case recorded, in which an aneurism of the aorta had become ruptured into the right ventricle, yet the lesion is one which it is not unlikely may again occur. That I am justified in this conclusion will, I think, appear, upon reference to the seven cases, described in the note.* In all

* *Cases of aneurism of the ascending aorta projecting and threatening to become ruptured into the right ventricle.*—Case 27. Mr. Smith, Dublin Medical Journal, vol. x. p. 423. Mus. Richmond Hospital, B. c. 2 n. 15. A biloculate aneurism, an inch above the right and left aortic valves; the larger sac projecting into the summit of the right, and the smaller one into the left ventricle.

Case 28.—Dr. Harrison, Dublin Medical Journal, vol. xv. 1839, p. 298. Mus. Trinity College. An aneurism of the right aortic sinus, the size of two walnuts, projecting into the top of the right ventricle. The aneurism likewise implicates the greater part of the right aortic valve: there is adhesion of the pericardium, extensive fibrous degeneration of the heart, and a real aneurism of the base of the left ventricle.

Case 29.—Mus. King's College, of London. H. 28 a. A very beautiful specimen.

Case 30.—Same collection. H. 41 a. A similar specimen, but mutilated. Aneurism in both cases, confined to the right aortic sinus.

Case 31.—Mus. Royal College of Surgeons, London, No. 3510, from Mr. Langstaff's collection. This is a splendid specimen of an aneurism of the right aortic sinus, the size of an orange,

of these an aneurism of the very commencement of the aorta, had encroached, more or less considerably, upon the right ventricle, below the pulmonic valves; and was merely separated from its cavity by the thin and almost transparent aneurismal sac, which, in some cases, appeared to be on the point of rupturing.

The last and most common variety of spontaneous varicose aneurism of the ascending aorta, is that which results from an aneurism forming a communication with the pulmonary artery.

CASE VIII.

Spontaneous varicose Aneurism of the ascending Aorta and Pulmonary Artery. Death nine hours after the probable period of formation of the opening.

A merchant, of temperate habits, when thirty-five years of age, suffered from symptoms supposed

with very thin walls, and lined with coagula. The sac forms a large tumour in the top of the right ventricle; but it also projects, in a less degree, into the pulmonary artery, and into the pericardium, to the right of that vessel.

Case 32.—Mus. Guy's Hospital, No. 1478 (25). A specimen very similar, in every respect, to the last described; one of the pulmonic valves has become obliterated, from adhesion to the sac. See case described by Dr. Hughes, Med. Gazette, N.S. vol. iii. p. 206, Case 2nd.

Case 33.—Mus. St. Thomas's Hospital, No. 1444 A. An aneurism of the right sinus, the size of a walnut.

In all the cases, except the last, the aneurism also encroached more or less on the pulmonary artery.

to be premonitory of pulmonary consumption, but which soon disappeared. Nine years afterwards, he had a slight attack of hemiplegia, which left behind it some sense of coldness in the foot which had been paralytic. In his fiftieth year, he began to complain of a noise in his ears and of flatulency, with pains, and sometimes slight swellings in his hands and feet. These symptons continued, more or less, for more than three years. At the end of this time, he one day fatigued himself with walking; after which he ate a hearty meal, and, having refreshed himself by some sleep, began to play about with his children. Whilst so engaged, he was suddenly seized, between eight and nine in the evening, with great oppression in the chest; and he soon afterwards vomited. He went to bed, but, though the weather was warm, and he was covered with bed clothes, his skin felt cold to the attendants. At midnight, he laboured under a constant cough, and expectorated mucus tinged with blood. His body was moistened with a cold sweat, and his pulse was extremely feeble; sometimes it was scarcely perceptible. About five in the morning, when seen by Dr. Baillie, the pulse was full and irregular, the breathing difficult, the skin pale and covered with a clammy sweat. He frequently tossed and writhed his body, as though suffering great pain and uneasiness: the mental faculties, however, were unimpaired. He shortly afterwards expired; having, just before, complained much of heat in his chest, and thrown off the bed-clothes to cool himself.

Dissection.—The lungs were congested: each pleura contained about ten ounces of bloody serum. There were some adhesions of the right pleura. The pericardium contained about two ounces of fluid, like that in the pleura. The cavities of the heart and great vessels were very much distended with blood. The ascending aorta had a circumscribed aneurism, the size of an orange, growing from above the right and left aortic sinuses. The aneurismal tumour adhered to the pulmonary artery, just below its bifurcation. Within the circumference of this adhesion, there was a narrow hole, with jagged borders, half an inch long, by means of which a communication was formed between the two arteries.*

CASE IX.

Spontaneous varicose Aneurism of the ascending Aorta and Pulmonary Artery.

A porter, aged 24, much accustomed to the lifting of heavy weights, who, ten years previously, had suffered from a severe attack of acute rheumatism, was attacked which pneumonia, which yielded to copious depletion. He, however, soon began to suffer from palpitation and dyspnœa, and, at the end of six months, from dropsical swelling of the lower

* Dr. Wells, Trans. Soc. for Med. and Chirurg. Knowledge, 1812, vol. iii. p. 85. See the preparation, Mus. St. Thomas's Hospital, 618 A, marked "Dr. Wells' case," from which I have obtained some of the post mortem appearances.

extremities and abdomen. These symptoms all rapidly increased, and, ten months after the attack of pneumonia, he was admitted into the Edinburgh infirmary. His countenance, was tumid and somewhat livid; there was great general uneasiness, orthopnœa, cough with expectoration, ascites and anasarca. The pulse 112, was large, hard and *thrilling*. There was much dulness on percussion, in the præcordial region; the action of the heart was tumultuous, diffused, over a large space, not strong; the first sound was accompanied by a loud blowing murmur, most distinct at the middle of the sternum, but audible over the whole fore part of the chest, and on the back, on both sides of the spine. The second sound was short, and much obscured by the first. ("Hence," observes Dr. Hope, "it appears a continuous murmur, extended from the first over the second sound.") The treatment consisted of a small bleeding and diuretics. The bleeding had the effect of temporarily relieving his general uneasiness, and the pulse was reduced, and the quantity of urine increased, under the use of the other remedies. The general symptoms, however, remained unrelieved; the anasarca increased, the pulse became intermittent, and he died a fortnight after admission into the infirmary.

Dissection.—There were several pounds of serum in each pleura. The heart was more than twice its usual size, and encroached on the left lung. It was pale, flabby, blunt towards the apex, and had its several cavities and orifices much dilated. The

walls of the ventricles retained their usual thickness. Except a thickened condition of the aortic valves, there was no disease of the valves of the heart. The ascending aorta was reddened, and it was rugous on its internal surface from the presence of numerous cartilaginous patches, which had advanced, in some parts, to ossification. The whole of the ascending aorta was dilated into a large, irregular sac, which adhered firmly to the pulmonary artery, and communicated with it, by two openings, situated an inch and a half from its valves. The large opening was capable of receiving the point of the little finger; the smaller of transmitting a crow-quill. The edges of both were regular, round, and cartilaginous. Nearer the arch, a third, small opening was discovered, with thin, ragged edges.*

CASE X.

Spontaneous varicose Aneurism of the Aorta and Pulmonary Artery. Death in about twelve hours after the probable period of formation of the opening.

A man aged 36, of intemperate habits, was attacked, six months before death, with dyspnœa and palpitation. These symptoms had continued for more than four months, when œdema of the feet appeared; and he was soon afterwards admitted into the Royal Infirmary, Edinburgh, under the

* Dr. David Munro, by Dr. Hope, "Diseases of Heart," 3rd ed. p. 469: also, as given by Dr. Henderson, Edin. Med. and Surg. Journal, vol. xlv. p. 322.

care of Professor Alison. He then suffered from confirmed symptoms, general and physical, of disease of the heart; the pulse was small and weak, and there was a double murmur which was prolonged with the diastole of the heart. A fortnight after admission, he felt occasionally as if he were going to faint, had a sense of uneasiness in the epigastrium, and from this time the symptoms all increased in severity, except that, under the free use of drastic purgatives, a considerable diminution of the œdema of the legs and scrotum took place. Soon after noon, one day, five weeks from admission into the infirmary, and after the operation of elaterine and camboge, the dyspnœa suddenly became much increased, the lips, which had previously been pale, became livid, and the pulse feeble, and he died during the night.

Dissection.—There were about three pints of serum in the cavities of the pleuræ, and eight ounces in the cavity of the pericardium. The heart was very large, the right cavities were dilated, and full of blood, chiefly fluid, the ventricle being also hypertrophied: the left ventricle was dilated. Two of the aortic valves were relaxed and elongated, so as to be inadequate to the closure of the mouth of the artery. The mitral valve was healthy; there was an aneurismal sac, the size of an orange, of the ascending aorta, directly above the valves, and pressing upon the left auricle: this sac communicated with the pulmonary artery, by a ragged transverse fissure, more than an inch in length, and situ-

ated an inch and a half above the pulmonary valves. The coats of the aorta were thickened and irregular on the inner surface.

The cavity of the abdomen contained about a pint of serum. The liver was large, granulated and highly mottled. The stomach was much congested in the splenic extremity. The kidneys were mottled, by yellow deposit, in the cortical portion.

The brain was healthy.*

CASE XI.

Spontaneous varicose Aneurism of the Arch of the Aorta and the left Pulmonary artery, corresponding to the situation of the Arterial Duct.

Under the above head, I shall briefly allude to a case, interesting from its anatomical details, which has been published by Dr. J. Reid.† It is that of a man, aged 60, of whose symptoms nothing is recorded, but that he had laboured under considerable dypsnœa, with symptoms of hypertrophy of the left side of the heart. He died shortly after admission into the Royal Infirmary; and on

Dissection, the ascending aorta was found much dilated, the transverse portion of the arch, nearly of its usual size, and the descending aorta,

* Dr. J. Reid, Edin. Med. and Surg. Journal, vol. liii. p. 99. The preparation is preserved in the museum of the Edinburgh University. The physical signs which are noticed as having existed in this case, are obviously referrible to the diseased state of the aortic valves, &c., and not to the varicose communication.

† Ed. Med. and Surg. Journal, vol. liii. p. 101.

from the origin of the left subclavian to about an inch above the diaphragm, about three times its usual calibre. From the right side of the summit of this dilated descending aorta, a small infundibuliform aneurismal sac, rather more than an inch in length, projected forwards, and to the right side, and opened into the left pulmonary artery, about a quarter of an inch beyond the bifurcation. The orifice of this sac, in the left pulmonary artery, was somewhat rounded, but at the same time irregular and fringed at the edges. Dr. Reid observes, that it may be difficult to decide whether the communication was or was not formed by the arterial duct opened up, and somewhat altered by an aneurismal dilatation on the aorta; but there can be no doubt that it lay exactly in the situation of the impervious cord, left by the obliteration of that vessel.

There were dilatation, hypertrophy, and valvular disease of the heart. The lungs were the seat of some masses of pulmonary apoplexy.

CASE XII.

Spontaneous varicose Aneurism of the ascending Aorta and Pulmonary Artery. Sudden death at the time of the probable formation of the opening.

A gentleman aged fifty-three, who had for some months complained of slight bronchitic symptoms, and of some præcordial uneasiness, was suddenly seized with violent dypsnœa, which was rapidly followed by insensibility, and in about four minutes from the commencement of the attack, by death.

Dissection, forty-eight hours after death.—The lungs contained a very considerable quantity of blood and some serum. The heart and all its valves were healthy: that portion of the ascending aorta between the upper part of the sinuses of Valsalva, and the origin of the brachio-cephalic artery, was dilated into an aneurism capable of containing the fist. The aneurism contained a few small clots of fibrine, and projected chiefly to the left side, and there the coats of the vessel were irregularly thickened, and contained numerous yellow patches. The left side of the aneurism adhered firmly to the trunk of the pulmonary artery, and communicated freely with that vessel, by a ragged irregular fissure, nearly an inch and a half in length.*

There is a case, reported by M. Sue, and presented to the faculty of medicine of Paris, by MM. Payen and Zink, † which has been cited by Otto, and after him, by Dr. Copland and other authors, as one of aortic aneurism, which had ruptured into the pulmonary artery. Upon referring to the case, I was strongly inclined to believe that the aneurism had *not* formed such a communication, though it had projected into, and almost entirely closed the cavity of that vessel. Some difficulty, however, existed in forming a just conclusion, from the occurrence of the word "s'ouvrant," in the

* Dr. J. Reid, Edin. Med. and Surg. Journal, vol. liv. 1840. p. 114.

† Bulletin de la Fac. de Méd. de Paris, vol. ii. 1809, No. 8, p. 128.

heading of the case, and I am indebted to the kindness of my friend, Mr. J. Kitching, for making, during his stay in Paris, a minute examination of the preparation, from which it is evident that no rupture of the aneurismal sac had taken place during life.

I shall refer in a note to five preparations, contained in the London Museums, and to one, in that of the faculty of medicine, at Paris, in which, a varicose communication had likewise formed, between an aneurism of the ascending aorta, and the pulmonary artery.*

* *Six additional cases of spontaneous varicose aneurism of the ascending aorta and pulmonary artery.*—Case 34. Museum St. Bartholomew's Hospital, No. 14. A circumscribed true aneurism, the size of an orange, above the attachment of the right and left aortic valves, and having a linear opening into the pulmonary artery, a little below its bifurcation. The ascending aorta is likewise generally dilated. This preparation is marked "Case described by Dr. Wells;" but this, I think, must be a mistake, see note to case 8. p. 351.

Case 35.—Mus. St. Bartholomew's Hospital, No. 15. A large, diffused true aneurism, of the ascending aorta; with a roundish, lacerated opening into the pulmonary artery, a little below the bifurcation.

Case 36.—Mus. St. Bartholomew's Hospital, No. 87. Very similar to the last specimen; but with a smaller and more linear, ruptured opening.

Case 37.—Mus. St. Bartholomew's Hospital, No. 102. An aneurism, the size of a large walnut, above the right and left aortic valves, projecting into the pulmonary artery just below the bifurcation, and communicating with it by a round hole, the size of a common quill. The aorta is also dilated, and its valves thickened.

History.—I have now related twelve cases, and, in a note described the preparations from six others, in which spontaneous varicose aneurisms had existed. Of these, three were seated in the descending aorta and inferior vena cava. The others, excepting one in the arch, were all seated in the ascending aorta or its sinuses; and communicated, one with the superior vena cava, two with the right auricle, one with the right ventricle, and eleven with the pulmonary artery.

The history of the disease, which I shall offer, will be founded upon an analysis and comparison of these cases.

The twelve patients were all of the male sex. Two were from twenty to thirty, four from thirty to forty, two from forty to fifty, three from fifty to

Case 38.—Hunterian Museum, No. 366. A large multiloculate aneurism, above the right and left aortic valves, projecting, partly into the pericardium, to the right of the pulmonary artery, and partly into that vessel, and into the right ventricle. The opening into the pulmonary artery is about a quarter of an inch across, round, and quite smooth. It is seated directly above the pulmonic valves. This preparation has been particularly described by Mr. Guthrie, "Diseases of Arteries," p. 60. This and the last are the only preparations I have examined, in which the appearances warrant the supposition, that the patients long survived the formation of the openings between these two large blood-vessels.

Case 39.—Musée de la Fac. de Méd. de Paris. "Anevrisme a l'origine de l'aorte; pérforation et communication dans l'artère pulmonaire."

I am not aware that the histories of any of the above six cases are preserved.

sixty, and one sixty years of age. One was by profession a merchant, one a coachman, much exposed to wet and cold, one a butler, one a baker, one a tinsmith, and another a porter: the three latter were all accustomed to lift heavy weights. The profession of the six other patients is not stated; excepting that one of them was a gentleman.

The habits of the merchant and baker were temperate; of the coachman, tinsmith, and another, (10), decidedly intemperate; whilst those of the other seven are not stated. One had sustained an injury on the back two years and a half before; another had complained, for two years, of severe pain stretching across the loins; and two had suffered from acute rheumatism, the one ten, and the other thirteen years before the appearance of symptoms of aneurism. One had had an attack of hemiplegia nine years previously, and had complained of pain and swellings in the hands and feet, for two years before the attack; one had suffered from dyspnœa and palpitation, during the greater part of his life; one from slight bronchitic symptoms and præcordial uneasiness for some months; and another from marked symptoms of disease of the heart, during six months. The foregoing features, however, in the history of the cases doubtless bear, principally, on the etiology of aneurism generally, and not on that of spontaneous varicose aneurism in particular.

It is only, of course, when aneurismal sacs, in the neighbourhood of venous trunks, have attained a certain size, and their walls a certain degree of tenuity, that they are liable to form varicose com-

munications. These communications would appear to be formed according to one of two principal modes. In six of the cases, the opening into the venous system seems to have been formed very suddenly; in consequence, in four of them, of some more or less unusual exertion or effort, previously to which the patient had been in ordinary health. In two of these cases (6, 7), the effort consisted in raising heavy weights; in one (8), in playing with children, after a fatiguing walk, which had been followed by a hearty meal; and probably in the other (10), it was the result of the action of drastic purgatives.

In these cases, there can be little or no doubt, that the aneurismal sacs were *ruptured* during the efforts alluded to; for in each of them, a set of symptoms, somewhat resembling those of a rupture of the heart, appeared suddenly, at the period of the more or less unusual exertion. In the first of the four cases, these symptoms consisted of a sensation of something giving way in the chest; in the next of faintness, dyspnœa, and palpitation, with pain, and a sense of something cracking about the heart; in the next of vomiting, oppression in the chest, and a constant desire to cough, with bloody expectoration; and in the last, of a sudden increase of dyspnœa and feebleness of pulse. In two cases likewise (3, 12), where the patient does not seem to have been exposed to any particular exertion, the preternatural communication was evidently formed in an equally sudden manner; and was indicated, in the one, by great

depression and violent vomiting; and in the other, by severe dyspnœa and insensibility.

In three of the cases, the mode of attack is not particularly specified; in another, however, (4,) we find that there was no sudden seizure, but that the patient suffered for some time, from pains in the neck and shoulders, which ceased more or less completely, as the symptoms of the varicose communication appeared. In the three cases (1, 2, 3,) in which the aneurisms were seated in the descending aorta, the symptoms were preceded by pains in the region of the back; and, in the two former of these also, there appears to have been no sudden seizure. In most of these cases, then, we may suppose that the openings resulted from a *gradual softening or ulceration* of the walls of the sack, without any decided rupture. This, I conceive, would likewise have been the mode in which the communication would have taken place in the other instances, had not the patients been exposed to such efforts as have been alluded to.

Symptoms.—The symptoms of a varicose aneurism of the aorta and vena cava, will, probably, be best understood by a division into those connected,—1stly, with the external surface and system generally; 2ndly, with the respiration; and, 3rdly, with the state of the heart and great vessels.

1. Excepting two or three cases in which the patients died almost immediately, the external surface in all presented very decided signs of an ob-

structed circulation. In four (1, 2, 7, 8), the animal heat appeared to be more or less remarkably deficient. In six the surface, especially that of the face, was livid or bloated; and in one of these (7) the livor extended to the mucous membrane of the fauces and soft palate, the colour in the face being of a peculiarly pallid character. In one of the cases (2), in which the descending aorta and inferior cava were the seat of the lesion, the veins of the abdominal parietes were large, tortuous and distended. In the two cases in which the opening was in the superior cava, many of the superficial veins of the upper half of the body, particularly those of the face, neck, front of the chest, and back, were permanently distended, and almost varicose. A similar but more general condition of the superficial and other veins, also existed in two other cases (5, 7).

Dropsical infiltration of the surface was the most uniform symptom noticed, and was present in all the cases, eleven in number, in which the symptoms are detailed, excepting three, (3, 8, 12,) in which death very speedily occurred after the formation of the varicose opening. The anasarca in all was very decided, and advanced very rapidly: in one case (7), it made its appearance on the twentieth day from the date of the intervascular communication. It involved all those parts of the body, the veins of which were distal to the opening in the venous system. Thus in the case (4) in which the aneurism opened into the superior cava, and in that in which it opened into the top of the right auricle (6), the anasarca of

the face and arms was remarkably contrasted with the uninfiltrated state of the lower half of the body. In two cases (1, 2), in which the abdominal aorta and inferior cava were the seat of the varicose aneurism, the anasarca of the legs and lower half of the body was equally strongly contrasted with the free, and in one case, emaciated state of the arms.

In three other cases, in which the aneurism opened into the appendix of the right auricle, the right ventricle, and the pulmonary artery respectively, the venous system of the whole body being distal to the varicose orifice, we find that the dropsical infiltration was little short of being universal; though, as in all cases of general dropsy, the lower extremities were most decidedly affected. There was, likewise, more or less ascites in these three cases. The extreme debility, also, with emaciation, which was noticed in two of the cases, (4, 7,) ought, probably, to be regarded as a symptom proper to the lesion under consideration. In one instance (2), sloughy sores formed on the shins; and in another sloughing of the scrotum supervened on the operation of acupuncture.

2. Excepting two cases (1, 3,) in which this symptom is not mentioned, there was more or less dyspnœa in all; but in four (2, 4, 7, 11,) the oppression and difficulty of breathing were not very severe, excepting, in most of them, towards the fatal termination, and were chiefly noticed after exertion. In the other six cases (5, 6, 8, 9, 10, 12,) the dyspnœa was extreme, and amounted to ortho-

pnœa, in the two former, of a most aggravated character, the patient dying from a slowly developed apnœa (asphyxia). There appears to be reason for believing that the urgency of the symptoms generally, and especially of the dyspnœa, is in proportion to the size of the opening into the vein, and to its proximity to the lungs; and, consequently, that this symptom, *cæteris paribus*, is more severe when the aneurism communicates with the pulmonary artery, than when it opens into the inferior or superior cava. Cough is stated to have been present in every case but five, (1, 3, 10, 11, 12); and in several instances it was particularly distressing. It was almost uniformly attended by expectoration; and in two cases only, where there was cough, (5, 6,) is this symptom not mentioned. The sputa were more or less mixed with blood in three of the cases, (4, 7, 8).

In order to estimate how far the symptoms referrible to respiration, were connected with the varicose aneurism, it will be well to consider the state of the lungs and pleuræ, as observed after death. In one case (4), the pleuræ were uniformly adherent, and in seven hydro-thorax, to a greater or less extent, was present; though, perhaps, in four cases only (6, 7, 9, 10), was the fluid in such quantity as to have materially affected the respiration. It is most probable, that this effusion into the pleural cavities is to be regarded as a consequence of the varicose communication. In one case (11), there was pulmonary apoplexy; but, excepting for the

most part, slight congestion and œdema of the tissue of the lungs, in five or six instances, these organs appear to have presented no other lesion. It may then be observed, that the severity of the dyspnœa, &c., in very few of the cases, bore any proportion to the degree of pulmonary complication; consequently we must, in the main, attribute these symptoms to the varicose aneurism.

3. In five of the cases (4, 6, 7, 9, 10), there were palpitations of the heart, and, in one, (7,) præcordial pain. As, however, these were precisely the cases in which the heart itself presented the most decided traces of disease, in the shape of hydropericardium, dilatation and valvular lesion, it is doubtful how far we can look upon the symptoms alluded to, as directly belonging to the varicose communication, The pulse presented distinctive characters in all the cases, eight in number, in which it is noticed; if we except one (4), in which it is briefly stated to have been "hard," a character which it is difficult to reconcile with a communication between the ascending aorta and vena cava. In four of the cases (2, 5, 7, 9), the pulse was decidedly "jerking;"—the terms, "vibratory," "hæmorrhagic," "resilient," and "thrilling," applied by three of the observers, evidently referring to one and the same character. In another case (6), it is stated that there was a distinct interval between the impulse of the heart, and the pulse, as felt at the wrist. In the other two cases, the pulse

was chiefly distinguished by being extremely feeble; and this was likewise the case in two of the instances in which it was jerking. In one (7), the pulse was much weaker in the left than in the right wrist; and in three cases (7, 8, 9), it became either intermittent or irregular in the process of the disease.

Physical Signs.—In the first only of the two cases of varicose aneurism of the descending aorta and inferior cava (1), were the physical signs noted; and in this they consisted of a pulsating tumour of the abdomen, with an incessant whizzing sound proceeding from the same part, and audible both to the patient himself, and to those around. In the case in which the aneurism opened into the superior cava (4), there was a distinct impulse detected under the right clavicle, and on the right border of the first piece of the sternum; and a loud murmur was also heard in the same situation. In the case in which the aneurism communicated with the appendage of the right auricle (5), a distinct pulsation and a bellows murmur were also perceived on the right of the sternum.

In the instance in which the varicose communication existed between the ascending aorta and the upper part of the right auricle (6), there was a loud double bellows' sound, which was particularly heard over the upper part of the sternum; the systolic portion of the sound was more prolonged, the diastolic sharper and shorter.

The physical signs, as observed by myself, in the case in which the aneurism opened into the sum-

mit of the right ventricle (7), differed remarkably from the preceding, as to the situation in which they were heard. There was dullness on percussion in the præcordial region, which extended to the level of the second rib. The healthy sounds of the heart were scarcely audible, and that only in the arteries of the neck. Throughout the præcordial region, and indeed over nearly the whole thorax, a continuous sawing sound was heard. This sound was loudest during the systole, less loud during the diastole, and still less so during the interval: it was most distinct in the second intercostal space, about an inch and a half from the sternum; where, in a spot that might be covered by a shilling, it was intensely loud and superficial; and in the same spot there was a most distinct and superficial purring tremor. In this case it is to be recollected that the heart was displaced somewhat to the left, by dropsy of the right pleura. Dissection proved that the spot where the murmur was heard and the tremor felt most distinctly, corresponded precisely to the situation of the varicose orifices.

The physical signs in the first of the cases of varicose aneurism, connected with the pulmonary artery (8), were not at all noticed, but it is to be observed that this occurred prior to the great discovery of Laennec. In the next case (9), in addition to increased though not forcible impulse, and dullness on percussion, in the region of the heart, there was a loud blowing sound heard over the front and back of the chest, but most distinctly at the middle of

the sternum. In this case also the murmur would appear to have had a continuous character. In the remaining cases the physical signs do not appear to have been noticed, at least not after the formation of the varicose opening.

There are a few other symptoms mentioned in the details of the cases, which are not referrible to any of the three heads under which I have arranged them. With one or two exceptions, however, to which I shall allude, these were evidently either the effects of the aneurismal tumour on surrounding parts, or were dependent upon complication with other diseases, and, consequently, need not detain us. In two cases (4, 6), there was gradually increasing dizziness, and confusion of the intellectual faculties, which ended in delirium and stupor; and which, though the brain was not examined, can scarcely be doubted to have depended upon a congested state of the cerebral veins, the result of the impediment to the return of the blood of the superior cava. To the same train of symptoms are likewise to be referred the congested and even blood-shot state of the eyes, and the ultimately impaired condition of the speech, which were also observed in one of these cases (6). In one case (2), there was considerable hæmorrhage from the urinary system; and in another (4), from the bowels.

Pathology.—When a communication exists between the ascending aorta and an adjoining part of the venous system, the arterial blood, in conse-

quence of the greater power of the left ventricle, is propelled through the opening, becomes mixed with the venous blood, and is carried forward with it to the lungs. The pathological effects consequently resulting, are hence obviously referrible to one of three circumstances.

In the first place; a portion of arterial blood is abstracted and regurgitated from the arterial system; and the arteries, consequently, are imperfectly filled. As a consequence, the pulse is feeble, and peculiarly jerking; the surface, and especially the countenance, loses the ruddy hue of health; the animal heat is diminished; and, the various organs being imperfectly nourished and stimulated, there arise emaciation, debility, loss of muscular power, with a disposition to syncope, to gangrene, and even to softening of the heart and internal viscera.

Secondly; the stream of arterial blood, which is constantly passing into the venous system, acts as a direct and powerful impediment to the return of the venous blood from the veins distal to the varicose orifice; and this is an effect which, in some cases, is assisted by the pressure of the aneurismal tumour. Hence arise, in the parts so situated, livor of the skin and mucous membranes; venous congestion of the glandular system, especially the liver; engorgement and dilatation of the right cavities of the heart; distention, and a varicose condition of the sub-cutaneous and deep-seated veins; passive

hæmorrhages; dropsical effusions, especially in the shape of anasarca; and venous congestion of the brain, with comatose and apoplectic symptoms.

Thirdly; the circulation through the lungs of a portion of already arterialized, in a state of mixture with the impure venous, blood, and in vessels not intended for its reception, acts, in all probability, as an abnormal stimulus or irritant to the pulmonary organs. We consequently have dyspnœa, cough, and the secretion, from the air cells and bronchial tubes, of a more or less viscid mucus, often tinged, or even mixed, with blood; and the lungs, after death, are frequently more or less congested, and may even be the seat of apoplectic effusions.

This is the proper place to consider the rationale of the physical signs of varicose aneurism of the aorta; but as the mechanism of abnormal murmurs of the heart and arteries is, to a certain extent, still *sub judice*, I shall content myself with a very few observations on this subject. I may remark, however, in passing, that some of the cases before us, and especially the seventh, offer many important features in relation to the mode of production, both of the normal and abnormal sounds of the heart and arteries.

As a consequence of the superior force of the left ventricle, the arterial blood is doubtless propelled through the varicose orifice, and so produces the murmur. During the systole of the heart, the current through the orifice is the strongest, and the sound consequently is then the loudest. During

the diastole, in consequence of the elastic reaction of the arterial system on its contained blood, a less powerful current is propelled through the opening, and at that time, a somewhat weaker murmur is heard. This reaction of the arteries, however, is in operation, not only during the diastole, but also during the interval, and, in fact, until it is overcome by the succeeding ventricular systole; consequently, though the current is stronger at the commencement of this reaction, and synchronously with the diastole, yet is it also continued during the interval. Hence, the murmur is a continuous one; it being present, though much weaker, during the interval between the diastole and the succeeding systole. The same circumstances which produce the murmur, of course occasion the purring tremor. I think there can be no doubt but that the extremely loud and distinct character of the murmur and tremor, are due to the generally small varicose apertures, through which the blood is propelled into the vein or right cavity of the heart; and that their intensity will be found to be in a direct ratio to the smallness of the aperture, and to the proximity of this to the walls of the chest. Like all other organic murmurs, the sound will be heard the loudest over the orifice in which it occurs; and, like them, will be propagated in the direction of the circulation beyond. Consequently, when the aneurism opens into the vena cava superior, or the right auricle, it is on the right border of the upper half of the sternum, that the sound will be chiefly heard,

and the tremor felt; but, when the communication is with the summit of the right ventricle or pulmonary artery, it is on the left border of the upper third or half of the sternum, that the sound and tremor will be the loudest and most distinct.

Diagnosis.—After the preceding analysis of the symptoms and view of the pathology, I think we shall be justified in regarding the following, as the diagnostic signs of spontaneous varicose aneurism of the aorta.

General signs.—1. Severe and rapidly advancing anasarca, of such portions of the body as are below, or the venous system of which is distal to, the varicose orifice. When the varicose aneurism is between the descending aorta and inferior cava, the legs, scrotum, and lower half of the body; when between the ascending aorta and the superior cava, the arms, face, and upper half of the body; and when between the ascending aorta and one of the right or left cavities of the heart, or the pulmonary artery, the whole of the body is the seat of the dropsical effusion.

2. Livor of the face particularly, but likewise, in a less degree, of all such portions of the body as are below the varicose orifice.

3. A distended, and even varicose, condition of the subcutaneous and other veins, distal to the orifice.

4. Dyspnœa; often amounting to orthopnœa and terminating in apnœa.

5. Cough, with expectoration; especially if the sputa be bloody.

6. A remarkably jerking, and in some cases, very feeble pulse.

7. Emaciation, debility, loss of muscular power, deficient animal heat and sensorial disturbance, may be looked upon as somewhat less frequent and certain signs.

Physical signs.—8. A superficial, harsh, and peculiarly intense sawing or blowing sound, accompanied by an equally marked purring tremor, heard over the varicose orifice, and in the current of the circulation beyond it; this sound is continuous, but is loudest during the systole, less loud during the diastole, and still less so during the interval. The characters of the sound, as regards intensity and continuousness, will probably altogether distinguish it from any that is heard in ordinary cases of aneurism, or valvular disease of the heart. In the case of a varicose communication between the aorta and superior cava or right auricle, when there is no displacement of the heart, the sound will be heard and the tremor felt, along the right border of the sternum; and will, generally, be the loudest about the second right intercostal space. When, however, the aneurism opens into the pulmonary artery or summit of the right ventricle, the corresponding points on the left side will be the seat of the murmur; though this may, probably, sometimes be heard more distinctly nearer to, though still to the left of, the centre of the sternum.

When the history shows that the foregoing signs have been developed soon after some unusual effort, especially if that were attended by pain in the præcordial region and a disposition to syncope, the evidence of a varicose aneurism of the ascending aorta is rendered nearly indisputable.*

Prognosis.—We have no grounds for believing, that when a varicose orifice has been once formed between an artery and a vein, in any part of the vascular system, it is susceptible of a spontaneous cure; and it is probable that when seated in the aorta, the lesion must necessarily sooner or later, and as the following details will show, in no long time, prove fatal. The duration of the disease, dated from the formation of the varicose opening, appears only to be indicated with precision in four of the cases. In four of them (3, 8, 10, 12), the cases had a general aspect, very much resembling that of rupture of the heart; and the patients survived, in one case only four minutes, and in the other three from nine to twelve hours each. In one of the other cases (6), the patient lived a month; and in the other (7), eleven weeks and two days. The prob-

* For some interesting and valuable observations on the signs and differential diagnosis of some of the above cases, see Dr. Hope, Diseases of Heart, edit. third, p. 471. Although the bulk of this paper was written more than a year before the publication of of Dr. Hope's remarks, I must, nevertheless, express my obligation, to a certain extent, to the views of that justly esteemed author.

able duration of the disease in the five remaining cases, was in one (4), about two months; in two (1, 5), about four; in one (2), five; and, in another (9), ten months.

As illustrative of the subject now under consideration, I may here allude to the anatomical characters of the varicose orifices. In eight cases (3, 8, 10, 11, 12, 33, 34, 35), all of which, excepting the first, were seated in the pulmonary artery, the openings were, for the most part, linear and irregular, and had jagged borders, indicating that the patient must have died speedily after their formation. In one case (38), the character of the orifice is not stated; but in the remaining nine the openings were round, and had more or less smooth and polished borders; so that the patient must be supposed to have survived a somewhat considerable period, to have allowed of such an extent of reparative change. The cases in which death occurred more or less suddenly, were, including the four above mentioned, seven in number (1, 2, 3, 6, 8, 10, 12); in the remaining five it took place in a much more gradual manner, and in one it very much resembled that from ordinary diseases of the heart.

Treatment.—The disease being, so far as we know, necessarily fatal, the indication of treatment will necessarily be confined to the relief of particular symptoms, such as the dropsy and dyspnœa. These objects are to be obtained, doubtless, by the same means as are resorted to in cases of valvular

disease of the heart; and, as in those lesions, all powerful and violent measures ought to be avoided. In the cases before us, we have no record of the result of treatment in five of the number (3, 8, 10, 11, 12). Out of the remaining seven, general bleeding was resorted to in three instances, but with little or no advantage, and perhaps even with injury. Dyspnœa and hæmaturia were materially relieved in two instances, after local bleeding by cupping and leeches. In five of the cases, powerful diuretics and drastic purgatives, such as squill, digitalis, elaterium, camboge, and calomel, were employed; but the dropsical symptoms were, for the most part, but little, and as might be expected, only temporarily relieved by these remedies. Acupuncture was resorted to in two cases (2, 7), and in both with considerable relief to the anasarca of the legs; but in one (7), it was followed by sloughing of the scrotum, which probably somewhat hastened the fatal termination.

The plan of treatment which the experience of one case, and the above considerations seem to me to point out, as likely to relieve the symptoms and to prolong life, is as follows. To relieve dyspnœa and the other results of congestions in important organs, by the cautious use of local bleeding; to attempt the removal of dropsical effusion by the employment of the milder diuretics and hydrogogue purgatives, such as the compound powder of jalap, squill, and blue pill; lastly, to increase the activity of the capillary circulation, by means of combina-

tions of diffusible stimuli, such as carbonate of ammonia, and the nitric or sulphuric ether, with the essential oils of the labiate plants, and camphor.

ANALOGY WITH THE ORDINARY FORMS OF VARICOSE ANEURISM, &c.—If we now compare the symptoms and pathology of spontaneous varicose aneurism of the aorta, as above given, with those of traumatic varicose aneurism of the extremities, I think it will be admitted that there is a very decided analogy between the two lesions.

According to M. Breschet, the latest and most accurate writer, at length, on this subject, the rational signs of varicose aneurism of the extremities, consist of numbness, loss of power, diminished heat, a blueish or slightly violet tinge of the skin, and a small and feeble pulse (which Scarpa states to be likewise vibrating), in that portion of the limb which is beneath the aneurismal tumour. Now the only signs of spontaneous varicose aneurism of the aorta, that we should at all look for in cases seated in the extremities, and which are not mentioned, are the distended and varicose state of the veins, the œdema, and the symptoms referrible to the respiration. But when we recollect the free inosculations which exist between all the principal veins of the extremities, and the absence of such in the vena cava, right cavities of the heart and pulmonary artery, it is easy to perceive why œdema, and a distended or varicose state of the veins below the opening, should be absent in varicose aneurisms of the extremities; and why they should be present in the same lesion,

when situate in the ascending or descending aorta. Again, the comparatively very small quantity of arterial blood which, in the former cases, circulates through the lungs, and the greater distance from these organs at which it enters the venous system, afford a sufficient explanation of the absence of dyspnœa, cough, and the other symptoms of pulmonary disturbance.

With respect to the physical signs of varicose aneurism of the extremities, it may be observed that by all authors who have treated of them, from Dr. William Hunter downwards, they are stated to consist of pulsation and purring tremor, in the situation of the tumour, accompanied by a decided, and, in most cases, *very loud* murmur, which is said, by some, to be propagated up the vein. The murmur, which has been variously described as a humming, whizzing, hissing, or roaring sound, is in some cases not merely audible when the ear is applied over the tumour, either with or without the stethoscope; but is also, as in that of Mr. Syme (1), and in the fifth reported by M. Breschet, audible to the patient himself, and even to those at some distance around him. In many of the cases also the sound is described as being alternately louder and more feeble, synchronously with the motions of the heart, so that a *continuous* sound would appear to have been present. Thus Dr. Cleghorn,* in describing the mur-

* Med. Observations and Inquiries, vol. iii. 1767, p. 115.

mur as heard in his case of aneurismal varix of the brachial artery, says "this thrilling noise is alternately higher and lower by regular jerks, corresponding to the pulsation of the artery." In the case, however, of spontaneous varicose aneurism of the femoral artery, already quoted from Mr. Perry, the continuous character of the murmur and purring tremor, is attested by the observation both of Mr. Perry and of Dr. Hope. Thus, Dr. Hope says, "There was a strong thrill and a remarkably loud murmur, *which continued without intermission*, though louder during the arterial pulsations;" and Mr. Perry observes, "this purring was quite distinguishable from the pulsation of the artery; for while the latter was lost in the intervals corresponding to the diastole of the heart, the former continued to be felt without intermission, deriving only renewed intensity from the repetition of the heart's action." It would thus then appear, that in the distinguishing, and perhaps pathognomonic characters of intensity and continuousness of the abnormal murmurs, we have, as we should have presumed *a priori*, a precise correspondence between the varicose aneurisms of the aorta and those of the arteries of the extremities. The enlarged state and increased pulsation of the artery above the tumour, in cases having their seat in the extremities, obviously correspond to the increased impulse and palpitations of the heart, which are generally, and perhaps always, present in cases seated in the ascending aorta.

I shall only just allude to the analogy which may

likewise be traced between the effects of the accidental and indirect communication between the left and right sides of the heart, in cases of spontaneous varicose aneurism of the ascending aorta, and those of the congenital and more direct communications, which are the result of original malformation of the heart.

ON ANEURISMS OF THE ASCENDING AORTA, RUPTURED INTO THE LEFT CAVITIES OF THE HEART.—We have seen, from anatomical examination and experiment, that aneurismal sacs, when situated in certain of the sinuses of Valsalva, or in certain portions of the ascending aorta, would be likely to form communications, not with the right, but with the left cavities of the heart. That this is a circumstance that may actually occur, the following cases will prove. In such cases, the lesion cannot, of course, be denominated a varicose aneurism, though both the general and the physical signs would, probably, have much analogy to those belonging to such cases.

CASE XIII.

Aneurism of the posterior Aortic Sinus, communicating with the left Auricle.

Dissection, of a man, aged forty, whose history, unfortunately, is not related. There were three or four ounces of serum in the pericardium. The heart was much enlarged. There was an aneurism,

the size of a large walnut, which opened into the aorta, immediately above the posterior aortic valve. The aneurismal sac projected, very slightly, into the pericardium. It was lodged, almost entirely, in the thickness of the inter-auricular septum, and projected into the cavities of both the auricles, though more into the left. It here presented four small elevations, of not more than half an inch in diameter. These proved to be secondary aneurismal sacs, and one of them presented an aperture of two or three lines in diameter.

The preparation is in the museum of the Faculty of Medicine, at Paris; and was presented by M. Beauchêne.*

CASE XIV.

Aneurism of the left Aortic Sinus, projecting and threatening to become ruptured, into the left Ventricle.

Under this head, I shall merely allude to a very interesting case, published by Dr. Hanna. The aneurism appears to have been caused by a fall from a horse, six months before death. The general and physical signs are well described, but, as they do not immediately refer to the subject now under consideration, I need not introduce them here.

The preparation is preserved in the museum of the Park Street School of Medicine, Dublin, where I have had an opportunity of examining it. The

* Bulletin de la Fac. de Méd. tom. ii. 1810, No. 3. p. 38.

aneurism is the size of a small orange, and communicates with the left aortic sinus, below the coronary artery, by a mouth not more than two or three lines in diameter. It forms a prominent tumour, in the upper and anterior part of the cavity of the left ventricle, from which, indeed, it is only separated by the extensively opaque and thickened endocardium. From the very small size of the mouth, in relation to that of the aneurismal sac itself, as well as from the history, I incline to think, that the case is one of false aneurism, which has dissected the muscular walls of the heart.*

The pathological effects, resulting from the rupture of an aneurism into either of the left cavities of the heart, would only partially correspond with those of a similar rupture into the right. They would, I think, be resolvable into those produced by, 1st, the abstraction of a certain quantity of blood from the arterial system, and the circulation of such current through the left cavities of the heart; which would act, 2ndly, as a powerful impediment to the return of the blood from the lungs. The effects thus produced, need not here be particularly pointed out. They would consist of great dyspnœa, hæmoptysis, &c.; and they would have considerable analogy with those occasioned by an extremely patescent condition of the mitral valve. The dropsical symptoms would appear later in the course of the disease, and then only as a conse-

* Dublin Journa of Medical Science, vol. vii. p. 80.

quence of the retarded pulmonary circulation. The essential characters of the pulse, and of the physical signs, would not vary from those of spontaneous varicose aneurism. The situation of the murmur, however, would doubtless be different. The sounds would be heard, most distinctly, lower down in the præcordial region, and probably in the neighbourhood of the left nipple.*

Retreat, near York,
December 1839.

* Whilst this paper was passing through the press, two additional cases of spontaneous varicose aneurism were published. The one was seated in the ascending aorta and pulmonary artery, and the other in the common iliac artery and vein: they were communicated, the former by Mr. Smith, the latter by Mr. Adams, to the Pathological Society of Dublin, in April last. (Dublin Med. Journal, Sept. 1840, vol. xviii. pp. 164 and 166.)

It is interesting to observe, that these cases afford additional confirmation of many of the views which have been laid down in this paper respecting the pathology and diagnosis of this remarkable form of aneurism. It may be also remarked, that from the publication of no fewer than eight cases, in as many months, we are perhaps warranted in concluding that this lesion is not a mere pathological curiosity, but, on the contrary, one with which the practitioner should be prepared occasionally to meet.

CASE

OF

A RARE SPECIES OF

HYDATID,

(THE *ECHINOCOCCUS HOMINIS*,)

FOUND IN THE HUMAN LIVER.

By T. B. CURLING, Esq.,

ASSISTANT-SURGEON TO THE LONDON HOSPITAL, ETC.

READ MAY 12TH, 1840.

James Havell, a muscular well-formed man, aged 71, was admitted into the London Hospital 18th Feb. 1840, labouring under an affection of the urinary organs. He died March 18th. On examination of the body, the left sterno-clavicular articulation was found destroyed, the cartilages and ligaments being ulcerated, and the joint in a state of suppuration. The lungs were congested, and there were a few pleuritic adhesions on the left side. The kidneys were large, flabby, and slightly granular. There was a small pouch at the fundus of the bladder, and a stricture in the urethra.

On opening the abdomen, my attention was attracted by a cyst connected with the margin of the left lobe of the liver. It caused a tumour projecting from the gland, which was slightly adherent to the peritoneum, covering the pylorus and commencement of the duodenum. This cyst was of an oval figure, and measured about $2\frac{3}{4}$ inches in its long diameter and $1\frac{3}{4}$ inches in the other. A section displayed an old hydatid cyst varying in thickness in different parts, and fibro-cartilaginous in structure, lined by a soft loose albuminous membrane enclosing a large number of separate hydatid cysts of various sizes from that of a pea to that of a large cherry, surrounded by and floating in a transparent fluid. These cysts which were exactly similar in structure to the *acephalocyst*, being white, opaque, and divisible into layers, were also found to contain a perfectly limpid fluid which remained unaltered in appearance after one of the hydatids had been immersed for several minutes in boiling water. On opening a cyst there escaped a large number of small white particles, some of which were found floating in the fluid within; whilst others were in contact with the inner surface of the membrane composing it. The latter appeared like grains of white sand thickly studded over the interior of the cyst. On examination in the microscope, these little bodies were ascertained to be the vermiculi of the *Echinococcus*,* all the characters of which were very distinctly perceived. They presented various

* They were detected by my friend Mr. John Quekett.

appearances, according to the position of the animal submitted to examination. In some, of which we had a lateral view, we could see the prominent head surrounded by a circle of hooklets, two of the four obtuse processes or suckers and the round caudal cyst behind. The average length of these as measured by a micrometer was one eightieth of an inch. In others again of which we had apparently an anterior view, the entire circle of hooklets were clearly discerned; in these the obtuse processes were invisible. Some of the animals represented in the plate seemed to be in a less advanced state of development. A number of them of various forms were collected within thin pellucid vesicles or cysts, which being ruptured allowed of the escape of the animalcules, and a multitude of minute rounded particles immiscible in the surrounding fluid. During the examination I observed in the field of the microscope several detached spines which were sharp-pointed and slightly incurvated. Nothing was observed capable of throwing light on the mode in which these animalcules are developed. The containing hydatid is not propagated like the *acephalocyst* of man, in which the gemmule is detached from the interior of the cyst, but the young cyst is excluded from the external surface. In some of the larger specimens two or three young cysts of the size of currants were observed in progress of development between the layers of the parent cyst.

I have not been able to meet with any account of a case in which this rare and curious hydatid has

been noticed in this country.* In the Hunterian Collection, there is a preparation of the *Echinococcus Hominis* described in the printed catalogue† as "Hydatids, on the inside of which are small ones; human: two preparations;" but on inquiry of Professor Owen I find that there is no further account of it. The Echinococcus Hominis has been observed in only a very few instances on the continent, and neither Rudolphi nor Bremser had met with it. A well authenticated example of its occurrence in the human brain is published by Rendtorf in a Thesis on Hydatids.‡ The account given of the animalcules discovered in that case is very imperfect and in the plate in which they are represented, but by no means well, only the coronet of hooklets is figured; the obtuse processes or suctorious mouths are not apparent. Müller has more recently described the case of a young man treated by Professor Necker for renal disease who voided with his urine a large number of these peculiar hydatid cysts. His description of the animalcules within them is minute, and accords very closely with this account which I have given of them, as observed in this case. He remarks however that the vermiculi were not present

* Since this case was read, I have found in the Medical Gazette (vol. xiii. p. 207.) a brief notice of a case of abscess in the liver, discharging echinococci through an opening in the parietes of the abdomen, by Mr. Rose of Swaffham, Norfolk.

† Part IV. Fascic. 1, No. 230.

‡ I have not been able to consult the original Thesis; but a pretty full account of the case, with a plate, is given by De Blainville in an appendix to his translation of Bremser's work on Worms.

in all the hydatid cysts, but that the cysts which contained them were exactly similar to those which were devoid of them.* In the case which I have here related the animalcules were detected in all the cysts examined in the microscope.

* Archiv. für Physiol. (Jahresbericht), p. 106. 1836.

OBSERVATIONS

ON

THE MODE OF UNION

OF

FRACTURES OF FLAT BONES.

By R. H. MEADE, Esq.,

LECTURER ON MATERIA MEDICA AT THE MIDDLESEX HOSPITAL.

READ JUNE 9TH, 1840.

The process of reparation by which union is effected in fractured bones, has excited so much attention, and has been illustrated by the labours of so many distinguished men in this and other countries, that it seems to require some apology for again entering on such a well-cultivated field. All the experiments however which I can find recorded, that have been performed on animals for the determination of the changes going on during the union of fractures, have been made on the long or cylindrical bones; and it is only from the inspection of a few dried preparations preserved in museums, and the occasional *post mortem* examinations of patients who have died after complicated injuries, that some vague ideas respecting the processes which go on in other bones, have been derived. It has been stated that in frac-

tures of the bones of the skull, and also of the other flat, and of the spongy bones, union is effected without the formation of any external or provisional callus; but I shall be enabled to show that this statement, though correct in some instances, is by no means generally true.

It is my intention, in the present paper, to detail several experiments which have been made on the flat bones of animals, for the purpose of ascertaining whether any essential difference exists between the mode of union of these and the cylindrical bones. The bone which I have selected is the scapula, which is easily fractured, and is essentially a flat bone; the two tables of which it is composed being in contact, in a great part of their extent: it contains however a considerable quantity of spongy tissue in the neck. The mode of union has been carefully observed in fractures traversing both these parts of the bone.

Experiment 1*st*.—The scapula of a young rabbit, about two months old, was fractured near the neck, 84 hours, or three days and a half, before death. On examination, the bone, with the periosteum covering it, was found to have been completely broken through, but the fragments were very little displaced. The surrounding muscles and cellular tissue were infiltrated with coagulated blood, but preserved nearly their natural texture; a small quantity of reddish-coloured gelatinous fluid was effused round the broken ends of the bones, beneath the muscles, and also partly beneath the periosteum, which was detached for a short distance from the edges of the

broken fragments. The same fluid occupied the space between the ends of the bones, and also the loose cancellous texture of the interior of the bone itself.

Experiment 2nd.—The scapula of a rabbit about three quarters grown was fractured, six days before the animal was killed. The bone was found to have been broken at some little distance from the neck, but in front of the flat portion; it was slightly comminuted. On making a careful dissection, it was found that the muscles on both surfaces of the bone, were of their natural colour, retaining no traces of effused blood. In the situation surrounding the fracture, they were converted into a firmish gelatinous mass, in which the natural arrangement of their fibres could scarcely be distinguished. When a longitudinal section was made through this mass, and through the broken bones, the periosteum was observed torn through; and the portions of this membrane in the neighbourhood of the fracture were thickened, and blended with the gelatinous mass formed by the deposition of lymph in the muscles and cellular texture. The periosteum was very easily separated from the surface of the bone for a considerable distance on each side of the fracture, but no new matter was deposited between them. Opposite the place of fracture, where the periosteum had been ruptured, the lymph effused externally to this membrane closely adhered to the denuded edges of the bone itself; some firm reddish-coloured lymph was found between the fractured edges of the bone

(though not adherent to them) and in the cellular texture or diplöe of the bone.

Experiment 3rd.—The scapula of a rabbit, about the same age as the last, was fractured near the neck, and the animal was killed 12 days afterwards. On examination a considerable quantity of callus of a firm fibro-cartilaginous consistence was found encircling the ends of the bones, which slightly overlapped. The muscles were adherent to this mass of new matter, but of their natural consistence and texture. On making a section, it was found that the over-lapping portions of bone were firmly connected together by cartilaginous tissue, in which, as well as in the external callus, numerous bony particles were irregularly deposited. The callus nti-mately adhered to the fractured edges, which appeared to have been rounded off, and also to the external surfaces of the bone, to some distance from the place of fracture. The periosteum was so blended with the callus that it was difficult to determine whether that membrane was external to or beneath it; but it seemed to be principally in the latter situation.

These three experiments were all performed on the thick part of the scapula; I shall now relate several in which the bone was fractured through the thin flat part.

Experiment 4th.—The scapula of a guinea-pig, about three parts grown, was broken across the blade; the animal died at the end of five days. On examination it was found that the periosteum was entire, and

that there was no thickening or effusion of blood in this membrane or surrounding textures. On removal of the periosteum the portions of bone were found to be separate, but accurately in contact with each other; and a small quantity of whitish gelatinous fluid was effused between them. There was little or no deposition of lymph along the external line of fracture beneath the periosteum.

Experiment 5th.—The scapula of a young rabbit, of about two months old, was fractured across the blade seven days before the animal was killed. On examination, no signs of fracture could be detected on the dorsum or external surface of the bone, on which the periosteum was entire. The under surface, or subscapular fossa, presented an unequal line stretching across from one side to the other. A small quantity of whitish matter of a semi-cartilaginous consistence was deposited along this line, with which the edges of the periosteum, which had evidently been here ruptured, were blended. A very considerable mass of callus was deposited over the place of fracture, on the inferior edge, or costa, of the bone. The whole scapula seemed swelled or expanded across its centre. On making a section, the external table of the bone was found to be entire, and seemed only to have been bent; the inferior table, on the contrary, was broken through, and one fragment slightly overlapped the other. The inequality thus produced was filled up with coagulated lymph of almost cartilaginous consistence, which firmly adhered to the fractured edges, and extended over them to some

distance, beneath the lacerated portions of periosteum, which were thus separated from the surface of the bone. The diplöe or space between the two tables was filled with a considerable quantity of reddish gelatinous fluid, like coagulated lymph, mixed with blood, which adhered to the edges of the broken fragments, and extending between them, formed a communication with the external callus.

Experiment 6th.—The scapula of an old rabbit was fractured across the flat part, nine days before death. On examination, a considerable quantity of firm cartilaginous callus, forming a ridge, was found over the line of fracture on both sides of the bone, but in greater abundance on the inferior surface than on the dorsum. On making a section of the bone, the fractured edges were found in contact but disunited: the periosteum was closely connected with the callus, which seemed to have been deposited on both sides of that membrane, but principally on its external surface. The periosteum was firmly united to the surface of the bone up to a short distance of the margin of the fracture. Immediately over the fractured line the edges of the fragments appeared to have no connection with the callus surrounding them. The callus was partly osseous.

Experiment 7th.—The scapula of a young rabbit, about three parts grown, was fractured in the same situation as the last, ten days before the animal was killed. The appearances were the same as in the former experiment, except only that the callus was rather less in quantity. The animal had been fed

on madder, and numerous long particles of a red colour were found deposited in the callus, which was itself of the natural white colour of cartilage. The bones were generally tinged of a pink hue.

Experiment 8th.—The scapula of a young rabbit, of about two months old, was fractured thirteen days before the animal was killed. The bone was found to have been completely broken through, across its flat part, and the fractured portions overlapped at the lower edge of the scapula. When a section was made of this part, it was found that the broken edges were rounded off, and that the flat surfaces which were opposed to each other, to the extent of about a quarter of an inch, were united by ligamentous substance, which was firm and white; but in which no bony matter was yet deposited. The periosteum must have been ruptured, but a distinct membrane was stretched across the fractured part of the bone, to which the muscles were attached. At the upper margin of the scapula the fractured portion had remained in contact, the posterior fragment of the bone which was broken off having been bent downwards by the muscles, so that it overlapped the other at the lower edge, but remained in contact with it above. In the latter situation the portions of bone were united by new matter effused between the edges of the fragments, and there was no callus externally; on a section being made, a whitish cartilaginous line was found dividing the broken portions; which line was insensibly blended with the broken edges. The periosteum was

here stretched, apparently unchanged, over the fracture, and union was accomplished in the bony structure itself. The scapula was coloured with madder, but the newly-deposited matter was perfectly untinged.

Experiment 9th.—The right scapula of a full-grown guinea-pig was fractured twenty-one days before death. The edges of the bone were found overlapping each other to a considerable extent, and were united at their opposed surfaces by firm bony matter, which was strongly coloured, as well as the rest of the bone, with madder. The whole of the fractured scapula was much more deeply tinged with the dye than any of the other bones of the body. A membrane connected with the periosteum, but considerably thickened, was stretched over the projecting fragments of bone, to which membrane the muscles were adherent.

From these experiments, and many others of a similar kind, which I have performed on the scapula, it may be deduced, that union is accomplished in the thick part of this bone, exactly in a similar manner as it is in the cylindrical bones; viz., blood is first effused into the different tissues surrounding the fractured part; this blood is next absorbed, and coagulated lymph deposited in the substance of the muscles, and in the neighbouring cellular tissue, so as to form them into a solid gelatinous mass. The periosteum which has been ruptured, is separated from the fractured edges, and becomes inflamed and

thickened: lymph, which is usually of a redder colour than that which forms the external callus is also effused between the fragments themselves. At a later period, the external mass decreases in size, the muscles return to their natural texture, and a firm layer of cartilaginous matter surrounds the fractured spot, with which the periosteum is blended. This callus adheres firmly to the surfaces of the bone and dips down between the fragments, the edges of which become rounded off by the absorbents. Ossification then takes place by the deposition of earthy particles in the cartilaginous matter.

The process by which union is effected in fractures of the flat part of the scapula differs in some respects from the preceding, and also varies in different cases, in consequence of some varieties in the mode in which the fracture has taken place. In those cases in which the bone has been completely broken through, with the periosteum covering it, as in experiments 6 and 7, very little injury seems to be occasioned to the surrounding soft parts; in consequence of the bone breaking very readily, from its thinness, and the fragments suffering but little displacement, and therefore giving rise to very little inflammation or deposition of lymph in the muscles and cellular tissue, except in the immediate proximity of the broken edges. A considerable quantity of callus, however, is deposited along the line of fracture, with which the periosteum is blended, as in the fractures of other

bones, and this callus seems to become bony before any solid union is effected between the edges of the bone itself.

In most of the cases which I examined, I found a considerable difficulty in determining whether the periosteum was on the external surface, or between the callus and the bone, it being closely blended with the cartilaginous mass. Mr. B. Cooper seems to agree with this statement; for he says that in that stage when the effused matter has attained "the appearance, firmness, and elasticity of cartilage," . . . "this membrane is inseparably connected with the surrounding mass, much thickened, and easily detached from the bone, so as to give the appearance of the bone having been deprived of its periosteal covering; but the fact is, that it has only become *blended* with the effused callus." * Miescher, who is one of the most recent writers on this subject, makes two distinct stages in the formation of the provisional callus. In the first stage, the periosteum, cellular tissue, and muscles, he says, "all become swelled, indurated, and conneed t o gether, encircling the fracture as with a capsule." In the other stage, lymph is effused within this capsule, which forms the true callus, becoming bony, and is exuded from the surface of the bone itself. All this is perfectly correct, and I have seen this lymph, which is first effused in a reddish semi-fluid state, separating the bone from the periosteum. Miescher states, however,

* Guy's Hospital Reports, vol. ii. p. 195.

that when the latter substance has assumed a firm and vascular state, the external capsule is entirely absorbed and disappears; so that the periosteum lastly forms the external covering of the callus. My observations do not verify this description in *all* cases, though in many it is undoubtedly true; for in several instances where the callus had become partly osseous, the periosteum could distinctly be traced into the interior of the mass, and appeared to be much nearer to the internal than the external part of it. The true explanation seems to be, that though the greater part of the matter effused among the muscles and into the surrounding textures becomes quickly absorbed, yet it is not necessarily all removed, and that portion may remain which is in contact with the external surface of the periosteum; and, together with that membrane, may become blended with the callus effused from the surface of the bone itself. If I were to hazard a conjecture in what cases this will be likely to occur, I should say, in those where the periosteum has been separated for a little distance only, from the surface of the bone; for, as Mr. Gulliver has remarked, "the formation of new bone generally commences at the point where the periosteum separates from the shaft of the bone, so that the size of the external case of osseous matter seems to be determined by the extent to which the periosteum has been detached from the bone by the violence of the injury." *

* Edin. Med. and Surg. Journal, vol. xliv. p. 54.

Now, in a thin bone like the scapula, the degree of injury produced by the fracture is so slight, that in many cases the periosteum may not be detached for a sufficient distance to allow space for the formation of a mass of provisional callus which will effect the purposes intended to be answered by it; which, according to Dupuytren, are to prevent motion between the fragments; and in these cases it is probable that part of the external capsule remains. In the sixth experiment which I have related, the periosteum was found firmly attached to the surfaces of the bone up to the very margin of the fracture, and there was a considerable quantity of firm, and partly osseous callus, external to this membrane.

I have stated that the process of union of fractures of the flat part of the scapula varies in certain cases. I will now endeavour to point out these particular instances. In many experiments which I have performed, I have found that union is accomplished without the formation of any provisional callus. In the greater number of these cases the periosteum had remained entire, as in the fourth experiment which I have related; and I am inclined to suppose, that this circumstance will partly account for the absence of callus. In the first place, the fractured edges being prevented by the entire state of the membrane from irritating the muscles and surrounding textures, the inflammation which gives rise to the effusion of lymph and consolidation of these textures, so as to form the external capsule, is not produced: and the preliminary steps

in the formation of the provisional callus are wanting. In the second place, however, why is it that little or no exudation takes place from the surface of the bone beneath the periosteum, so as to form a ridge under this membrane? The only explanation which I can find for this is, that the periosteum is very little separated from the surface of the bone in these cases, and lymph seems only to be effused where the connection between these parts is destroyed. I find it mentioned by writers, that cylindrical bones are sometimes broken without the periosteum giving way. Mr. Gulliver refers to a specimen preserved in the Museum of the King's College, London, where both bones of the fore-arm of a child were fractured, without the periosteum being injured. He does not say, however, whether any callus was here formed. I can scarcely conceive it possible that the cylindrical bone of an adult can be broken without the periosteum giving way at the same time; at any rate, on one side. In a few cases, which I have noticed, where no provisional callus had been formed, the periosteum had apparently given way, and here the only reason that can be assigned for the absence of callus is, that the broken fragments had remained accurately in contact, and the direction of the fracture had been such, that complete immobility had been preserved; under which circumstances it has been premised, that union might take place, simply by the deposition of ossific matter between the extremities of the fragments It has been said, that where union is ac-

complished without the formation of provisional callus, the process is very slow; but in the eighth experiment which I have related, the upper edges of the fracture which had remained in contact, and which were covered by periosteum, were united by new matter effused between the fractured margins, as early as the thirteenth day; which new matter was of a cartilaginous consistence, and insensibly blended with the broken edges, and would doubtless soon have become osseous.

In the course of performance of the preceding experiment, I noticed one or two other facts, which I shall briefly state in concluding the present paper.

It has been stated by Macdonald, and repeated by other authors, that the cartilaginous matter forming callus, differs from true cartilage by becoming tinged red, when the animal has been fed on madder. I have distinctly observed that this is incorrect in many cases; the bones of the body generally having been found coloured, as well as the new bony particles deposited in the callus; while the cartilaginous matter surrounding these fragments has been perfectly white. I have been, by this means, enabled to observe, that the new bony particles are deposited irregularly through the provisional callus, and do not first arise from the surface of the old bone.

The lymph effused from the edges of the fractured bones themselves, and which fills up the interval between them, differs from that forming the provisional callus, in having a peculiar red gra-

nulated appearance. Mr. Howship, and latterly Mr. B. Cooper, consider that the coagulated blood plugging up the ends of the bones, actually becomes organised; but I could not find any other point of resemblance between this new effused matter and coagulated blood, besides the reddish colour.

I shall here conclude the present communication, and may observe, that the process of union in fractures of the scapula differs in very few, if any, respects, from that of the common cylindrical bones.

CASE

OF

ANEURISM

OF

THE ARTERIA INNOMINATA,

IN WHICH THE CAROTID AND SUBCLAVIAN ARTERIES WERE TIED.

By W. WICKHAM, Esq.,

SURGEON TO THE WINCHESTER HOSPITAL.

READ MAY 26TH, 1840.

Richard Colt, admitted into the Winchester County Hospital Sept. 17, 1839, aged 55 years, a tall spare man, of sallow complexion, having been a sailor in constant occupation, and having resided nine years in a tropical climate, during which time he had lived very freely, but always in the enjoyment of excellent health. On his return to this country he married, and resided at Lymington during four years previous to the time of his presenting himself at the hospital. He stated that about six months since he had observed a small swelling, about the size of a hazel nut, situated just above the right clavicle, at about its middle; that it was unaccompanied by any pulsation or pain, and that it disappeared in about eight

days: from which time, until about four weeks previous to the date of his entry at the hospital, he had no return of swelling, when suddenly his attention was attracted to another tumor about the same size, which presented itself just above the sternal end of the clavicle: this soon became painful, and the pain was much increased when he was in the recumbent posture. The pulsation too was now soon evident, and as the swelling enlarged it occasioned some difficulty in breathing; at the end of the four weeks he showed the swelling to Mr. Adams, a surgeon at Lymington, who considered it aneurism, and advised his coming to the hospital.

On his admission, the swelling had attained to the size of a hen's egg externally; it seemed that the tumour extended over the carotid artery at its lower part, reaching as high as the transit of the omo-hyoideus muscle: it inclined somewhat also towards the subclavian artery: it had all the characteristics of aneurism, and that of the innominata. The health of the man appeared tolerably good, with the exception of some degree of constitutional disturbance, arising from continued pain and difficulty of respiration.

On the 24th of September, the case was submitted to Sir Astley Cooper, who was on that day at Winchester. His opinion confirmed that already entertained, that the disease was innominatal, and his sanction was given to the experiment of tying the carotid and subclavian arteries.

Sept. 25th.—A ligature was placed on the carotid

artery immediately above the omo-hyoideus muscle which was somewhat pushed upwards by the tumour. The operation was completed without any difficulty or any unusual circumstance attending it. The arrest of the circulation through the vessel was complete. The immediate effect of the operation in no degree diminished or disturbed the functions of the brain. The aneurismal sac evidently lessened as soon as the ligature was tied, but the pulsation continued, though certainly with less force. The trachea was almost immediately relieved from pressure by the reduction of the tumour, and thereby the troublesome cough and dyspnœa considerably lessened. The patient throughout the day well, and feeling much benefitted by the cessation of those distressing sensations which the pressure of the aneurism had previously occasioned.

Sept. 26th, A. M.—Had passed a good night with more comfortable sleep than he had enjoyed for several weeks. Ordered a dose of castor oil: P. M. bowels relieved, sensations unaltered since the morning. No heat of skin, pulse moderate, regular and the same in both wrists. Pulsation in the tumour certainly less vigorous than before the operation. Ordered

℞. Tinct. Digitalis ♏. x.
Syr. Papav. ʒi.
Mist. Camph. ʒx.—every four hours.

Bladders partly filled with iced water to be applied to the aneurismal swelling.

27th.—Has passed a good night, but complains of

headache: on this account the Syr. Papaveris omitted in the draught—continue the Digitalis, and ice to the tumour.

28th.—Head better—bowels relieved—otherwise the same.

29th.—Well—ordered to continue the Digitalis twice a day. To use the ice occasionally, and persist in low diet.

No unfavourable symptom occurring, in the interval, the ligature came away on the fourteenth day after the operation; after which time the patient was allowed to walk about, and at the end of three weeks he left the hospital contrary to advice, but under the pretext of having affairs to settle at home, and with the promise of returning at the end of a week or ten days. At this time the tumour appeared of the size to which it was reduced immediately after the operation, and the pulsation as before the carotid was tied.

The patient was now surrendered to the care of Mr. Adams, who kindly undertook to watch the progress of the swelling, and to urge on the man the necessity of returning to the hospital to undergo the second operation, which it was hoped he would have consented to, at the end of a month from the first operation; all representation of the evils of delay, urged by Mr. Adams, failed, but driven by distress of breathing from the rapid increase of the tumour, he again presented himself for admission to the hospital, on the 27th of November, two months from the tying of the carotid.

At this time his appearance was very wretched, the difficulty of breathing extreme, cough very frequent, and deglutition much impeded. The tumour had increased to more than double its original size, and especially it had extended outwardly so as to overhang nearly half the clavicle.

Dec. 2nd.—A consultation of my colleagues at the hospital determined that the second operation should be performed on the following day.

3rd.—The patient had passed a night of great suffering, and more than ever from the difficulty of breathing, which continued to the time of the operation. When brought into the operating theatre, he was quite livid from the arrest of the circulation through the lungs, and his pulse excessively weak. He appeared to be almost at his last gasp from suffocation; and great fears were entertained lest he should expire under the operation. It was however agreed, that this was the only chance of relief, and inasmuch as the tumour had so decidedly lessened after the former operation, it was hoped that a similar effect might be produced by tying the subclavian. The operation was therefore undertaken without further delay in the following manner:—

The patient was laid on a table with his head and shoulders raised towards the light, so that it might fall from the skylight into the hollow of the incision. The skin being drawn down, an incision was made through the integuments upon the clavicle; it commenced near the acromion, and extended along the clavicle to the tumour, which now occupied about

one third of the clavicular region: the incision terminated by being carried a little upwards by the side of the external jugular vein, which was distinctly visible, and distended in consequence of the difficult respiration. It divided the skin and platysma myoides; the cervical fascia, now becoming exposed, by careful touches of the scalpel, and the aid of a director, was easily divided. The loose cellular tissue having been next cleared away, the situation of the artery was readily detected in its passage over the first rib; but it lay so far beneath the tumour and clavicle, that some difficulty was experienced in this stage of the operation. At first one of the cervical nerves, which received a pulsation from its contact with the artery, was mistaken for the subclavian, and a ligature passed under it: this mistake being at once discovered, it was not tied, but drawn away by this means from the artery, so as to bring it into view. A ligature was then passed around the vessel, by means of an aneurismal needle, made by Weiss, having an eye at the end of a spring which slips along a canula inserted into a firm handle (this needle being admirably adapted for the purpose). The artery having been firmly tied, the pulsation at the wrist ceased, the wound was dressed, and the patient put to bed. Relief from the dyspnœa was immediate, so much so that the man was able to walk with ease to his ward, and from that time he continued free from any inconvenient pressure on the trachea until he died, the direction of the

growth of the tumour having been subsequently diverted *outwards* towards the right shoulder.

On the next day, the patient was in every respect well: the tumour had manifestly decreased, but pulsation in the sac continued, though less in force, as on the former occasion. No pulse to be felt at the wrist. The heat of the arm greater than the opposite. He was treated as under the previous operation. No unusual symptom occurred until Saturday evening, Dec. 7th, when he was suddenly seized with delirium and muttering, a considerable increase of the aneurismal tumour, and violent pulsation of the heart and *left* carotid: it was so great as to shake the whole frame, and actually raise the head from its pillow. He was immediately bled to twelve ounces and took thirty drops of laudanum. The first part of the night was passed with but little diminution of the symptoms: after which however they gradually diminished, and by the following evening he became quite tranquil. From the time of this attack the tumour never diminished; on the contrary it gradually, though slowly, increased. His health continued to improve, and with the exception of occasional pain from distention of the swelling and pressure on the nerves over which the tumour was situated, his sufferings were comparatively mild.

On the 23rd of Jan. he became suddenly faint and weak with loss of appetite, which lasted a few days; and he again recovered sufficient strength to feel anxious to quit the hospital.

On the 25th of Dec. the ligature came away in the

dressings, and the wound speedily healed. He now sat up and smoked his pipe, which was his habit, and, although gaining no ground, feeling some confidence as to his ultimate recovery, he persisted in his desire to quit the hospital, which he did on the 5th of February. He returned to Lymington.

On the 15th of February Mr. Adams was called to him on account of profuse bleeding, which occurred in the evening: this was arrested by plugging and clots, but on the following morning, Feb. 16th, he bled again, and died without an effort.

Thus a period of about four months and a fortnight passed between the first operation and the death of the patient.

Post mortem appearances on inspection.—The *heart* was large and loaded with fat.

The *pulmonary artery*, nearly twice the natural size.

The *aorta* extremely dilated from its origin in the left ventricle through the whole course of thorax; specks of osseous matter appeared in its coats.

The *superior cava* was also greatly enlarged.

The aneurism had emanated from the *arteria innominata*, below its division into subclavian and carotid arteries. Nearly half of the innominata was occupied by the origin of the aneurism. A ligature upon the remaining part of the innominata would not have left space between it and the arch of the aorta for the formation of a clot, or adhesive matter.

The *sternum* was slightly absorbed at its upper part.

The *clavicle* had undergone progressive absorption from the pressure of the aneurism upon its inner and lower surfaces, and its articulation with the sternum had been destroyed, so that the clavicle became lifted upwards.

The *right* subclavian artery was obliterated from the clavicle to the first rib.

The *right carotid artery* was obliterated behind the tumour from just above the upper edge of the omo-hyoideus.

The *aneurismal sac* reached from the arteria innominata to the upper part of the thyroid cartilage.

The sac had burst upon its left side although it projected most upon the right side.

Winchester,
23rd May 1840.

CASE

OF

TUMOUR IN THE PELVIS,

IMPEDING PARTURITION.

By J. C. W. LEVER, Esq.,

ASSISTANT-ACCOUCHER TO GUY'S HOSPITAL LYING-IN CHARITY.

COMMUNICATED BY DR. MERRIMAN.

READ JUNE 23RD, 1840.

ON January 19th 1840, at 7 A.M. Mr. N. was called to Mrs. Colston, aged 28, in labour with her fifth child. Her previous labours had been remarkably quick, indeed so rapid, that upon one or two occasions, the child was born before the arrival of the surgeon. When Mr. N. saw her, he found that labour pains had commenced twelve hours previously, and on examination, he detected a tumour projecting into the vagina, impressing him with the idea that the rectum was full of fæces. The os uteri was felt above the tumour nearly dilated, and the head of the child presenting, her pains occurred at regular intervals, and were tolerably strong; he ordered her to take a dose of castor oil

immediately. At 1. P.M., the oil had operated well, and on making examination, the tumour was found to be pushed lower down: an enema was now administered, which acted very speedily: introducing his finger into the rectum, Mr. N. found the tumour was situated between the rectum and vagina, and on further examination, it was felt to contain fluid, and to the left side, there seemed to be a firm body, impressing the examiner with the idea that it resembled in feel, the upper extremity of a fœtus.

The pains were now very strong, and the patient had but slight intervals of ease. Mr. N. having requested my opinion of the case, I attended, and found the tumour as large as a fœtal head, occupying so much of the pelvic cavity, that the finger could with difficulty be passed between the tumour and the symphysis pubis, and on examining her rectum, the coccyx could not be passed; her pains were very violent and frequent. I advised the evacuation of the fluid contents of the tumour, thinking that if this were done, sufficient room would be obtained for the birth of the child, without diminishing the head. Having guarded a common lancet, I made an opening into the tumour, through the vagina, when upwards of a pint of an oily fluid immediately escaped, the sides of the tumour collapsed, the pains continued, the head rapidly advanced, and in two hours from the time of operation, she was delivered of a living male child, which was soon followed by the secundines. On placing the hand on the abdomen, after

delivery, the uterus was found perfectly contracted, while to the left side the firm tumour which formed part of the contents of the sac could be felt. The evacuated fluid, when cold, greatly resembled dripping.

After her confinement, no remarkable symptoms occurred until the 20th day after delivery, when she complained of a considerable degree of forcing, when she passed her motions; these symptoms led Mr. N. to examine her *per vaginam*, when the tumour was again detected between the rectum and vagina, and exceedingly tense.

According to my friend Dr. G. O. Rees' analysis, the substance contained a considerable quantity of cholesterine.

NOTE by Dr. MERRIMAN.

I requested Mr. Lever to permit me to lay this rather unusual case before the Society, not only because it is in itself curious and instructive, but because it very much illustrates the subject of ovarian tumours obstructing parturition, upon which I communicated a paper to the Society in the year 1819, which was honoured by publication in the 10th volume of its Transactions.

It especially bears great resemblance to the 5th case of my collection, from the circumstance of the fluid evacuated being oleaginous, and resembling when cold, dripping, or imperfectly-formed

butter. Mr. Lever's case demonstrates strongly, how advantageous it is in difficult labours for the patient to have already passed through the process of parturition. In Mrs. Colston's case, all the parts were ready prepared to perform their respective functions, and as soon as the impediment created by the tumour was removed, nature soon overcame all other difficulties. In my case, the woman was 35 years of age, it was a first pregnancy, and very little disposition or power existed in the parturient adjuvants to perform their duty.

In two other particulars Mr. Lever's case was more advantageously managed; artificial assistance was sooner employed, and the operation was, I believe, better fitted to ensure success: the tumour was opened through the vagina, and with a lancet, which I presume gave a greater facility to a more complete evacuation of its contents. In my case the tumour was punctured through the rectum, with a trocar, but the contents of the tumour were not readily evacuated, nor was the operation through the rectum successful in another case that fell under my observation. Upon the whole, the case communicated by Mr. Lever may be considered as favouring the opinion of Mr. Park, (Medico-Chirurgical Transactions, vol. ii.) that an incision into the tumour from the vagina is the proper mode of treating encysted tumours in the pelvis, obstructing parturition.

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TO THE

ROYAL MEDICAL AND CHIRURGICAL SOCIETY.

1839-40.

*** Those works which have been presented by their respective authors are distinguished by an Asterisk.

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EXPLANATION OF THE PLATES.

PLATE I.

REFERRED to in the paper of Mr. Liston, page 85.

Fig. 1.—A profile section of an abscess, the vessels of the lymph lining its parietes being injected.

a the lymph deposited in granules.

b the parietes of the abscess, or base of the lymph.

Large capillary vessels are seen passing into the lymph.

Fig. 2.—A section of granulations injected.

a the free surface.

b the attached surface.

The vessels passing into the granulations are varicose, and much convoluted.

Fig. 3.—A vertical section of the cartilage covering bone, inflamed.

a the cartilage.

b the bone.

Vessels are seen passing from the medullary web into the cartilage.

PLATE II.

Fig. 1 and 2, referred to by Mr. Dalyrmple, page 205.

Fig. 3.—Vermiculi of the echinococcus hominis.

A lateral view of the perfect animal.

B animal of a rounded form; the head and hooklets retracted within its body.

C animal imperfectly developed.

D anterior view, in which the entire circle of hooklets is exposed.

E detached spines highly magnified.

PLATE III.

Internal surface of the uterus, delineated as seen under water; showing the flocculent membrane adherent, and one of the large sinuses laid open.

PLATE IV.

Fig. 1.—The utero-placental arteries.

Fig. 2.—A segment of placenta, showing the circular marginal canal.

PLATE V.

Fig. 1.—Interstices of placenta injected from the semilunar apertures of the uterine surface.

Fig. 2.—Microscopic view of a vertical section of the placenta.

Fig. 3.—Terminal branches of the umbilical arteries, highly magnified.

The last three of the plates are referred to in Mr. Bloxam's paper, page 224.

Fig 1.

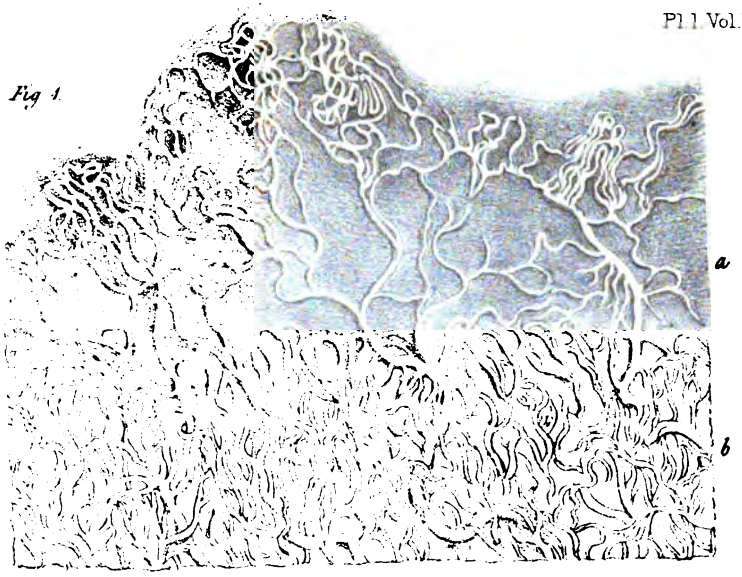


Fig 2

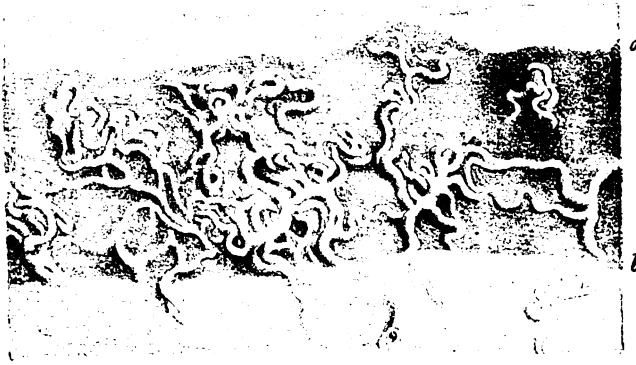
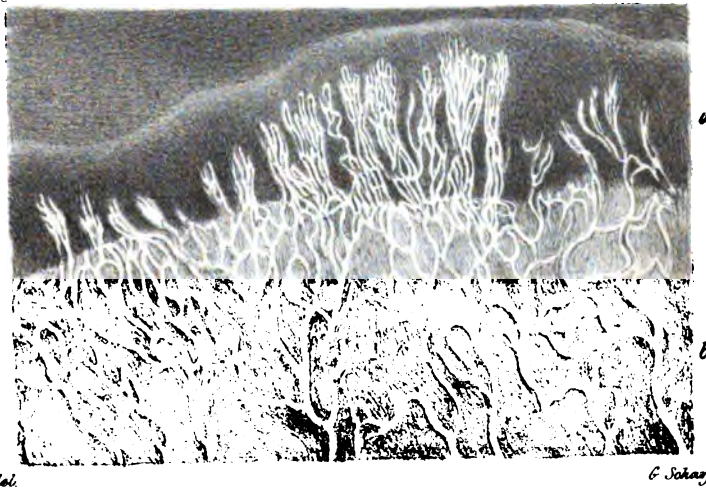


Fig 3



J Dalrymple del.

G Schaef lithog

Fig 1

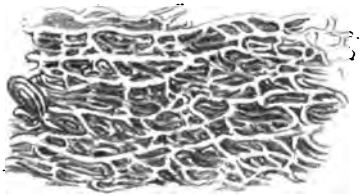


Fig. 2.

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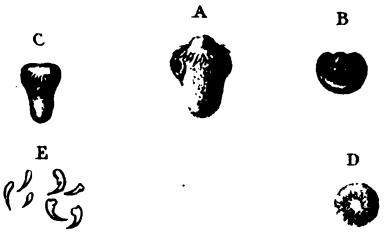
Fig. 3.



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Pl 3

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Fig 1

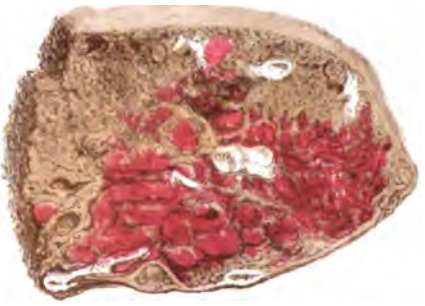


Fig 2

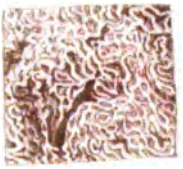
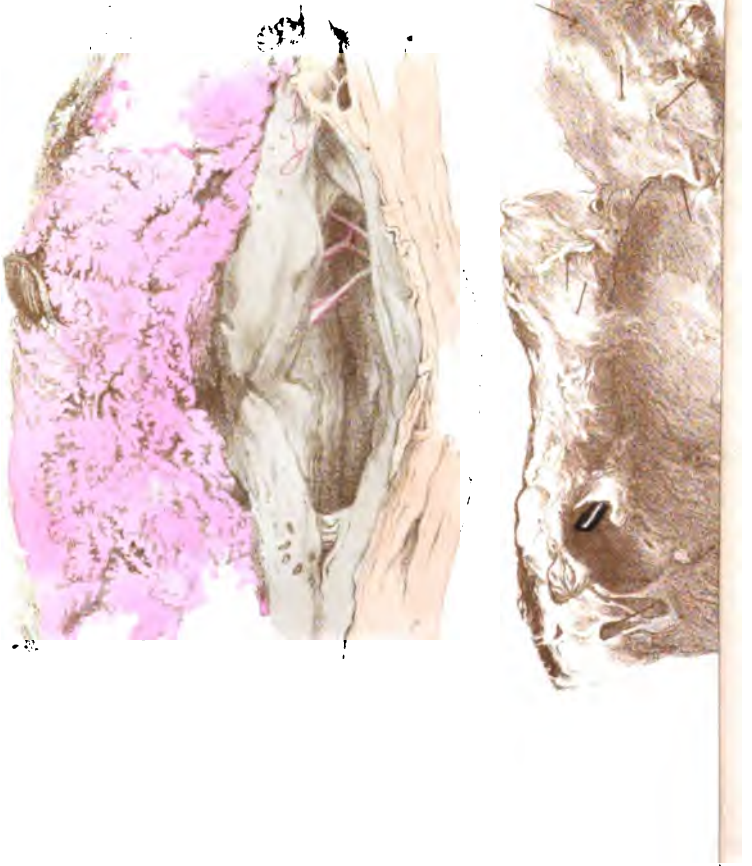


Fig 3

Fig 2 & 3 Magnified

Fig. 1



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